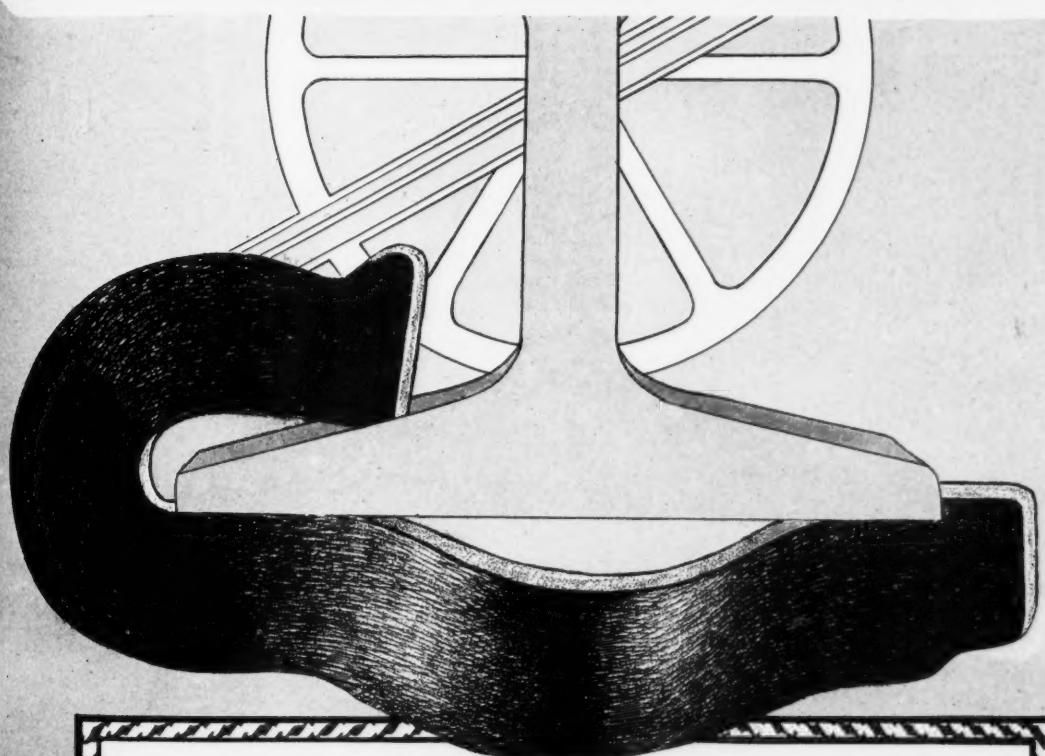
Railway
Engineering and Maintenance

FUNDAMENTAL PRINCIPLES



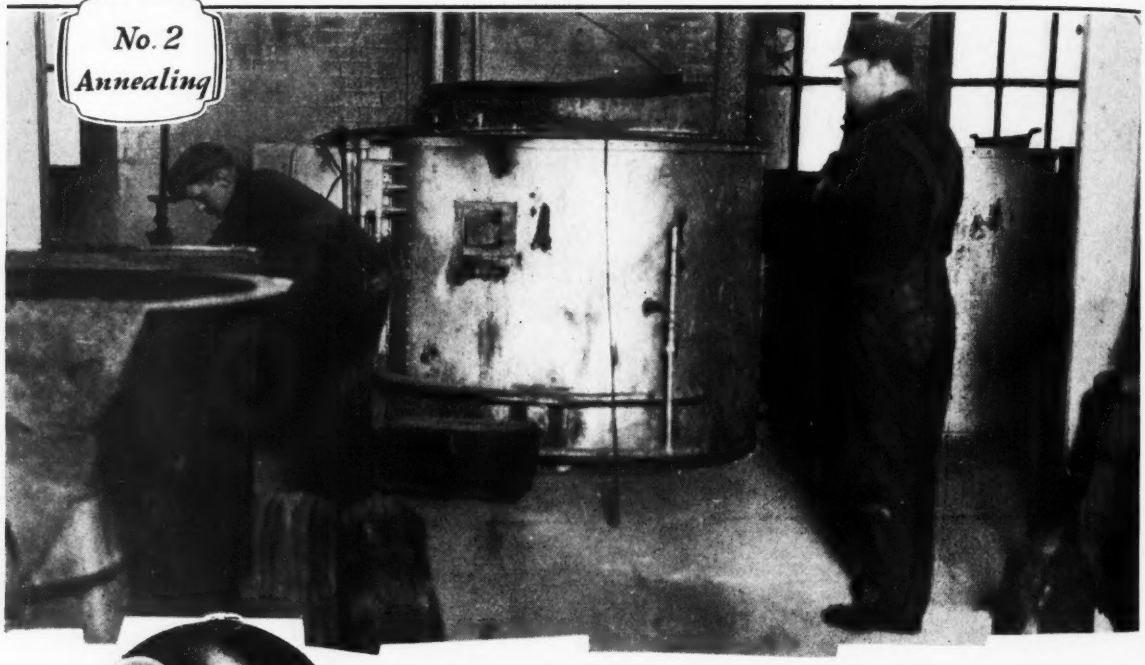
The basic design of the wheel or lever cannot be changed because they are basically correct.

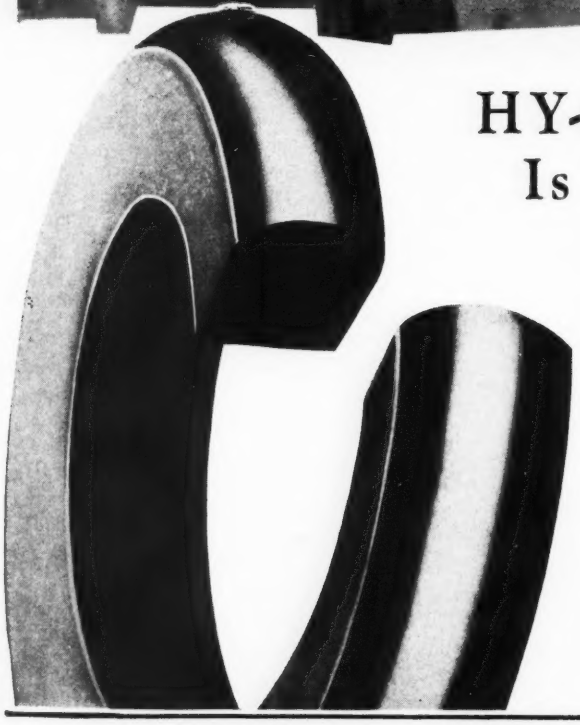
During the last eight years, when requirements have been most severe, the Fair Rail Anti-Creeper has proven that its design is basically correct, and therefore no changes have been made.

THE P. & M. CO.

CHICAGO LONDON NEW YORK
MONTREAL PARIS CALCUTTA SYDNEY

Scientific Reasons Why —





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ON its way, to and from the cold drawing mills, HY-CROME Steel passes through the latest scientific annealing process.

Lavite Furnaces maintain correct annealing temperature through automatic control, insure consistent, uniformity, greater production and eliminate scaling.

The great physical strength of HY-CROME is carefully protected by scientific methods during every manufacturing operation.

It's one of the major reasons why HY-CROME service guarantees positive rail joint security for a lower cost than the ordinary nut lock.

The Reliance Manufacturing Co.
Massillon, Ohio

HY-CROME

"The Most of the Best for the Least"

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Co., at 105 W. Adams St., Chicago. Subcription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

Alphabetical Index to Advertisers, Page 70 Classified Index to Advertisers, 66-68

THERE IS MORE VALUE IN A MUDGE CAR THAN YOU CAN SEE

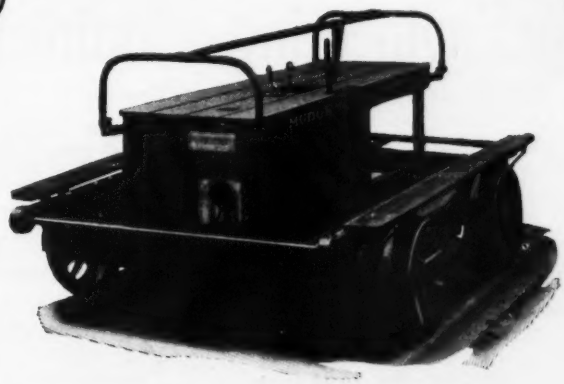
In the design and construction of motor cars, factors that seem trivial may have a vital bearing on the ultimate performance. The Mudge organization is trained to watch for every such factor. In the design of every minor detail, in the selection of every bit of raw material, the processing, the assembly of the various units, the test run and even in the work of the service men after the car is in use, there is manifest a determination to make Mudge cars as good as motor cars can be made.

For small section gangs

The Mudge Class A-1 "Light Section"

ROADS on which section gangs are kept small find in the Mudge Class A-1 car an economical and dependable means of handling men and materials. It will accommodate six men with their tools and is light enough to be taken on or off the track by two men.

The A-1 is powered with a 4 hp. free running, water cooled, belt driven engine; has the thermo-syphonic water hopper which greatly increases the cruising radius; is equipped with Mudge-Bower roller bearings on crankshaft and axles; and has many other highly improved features.



The Mudge Class A-1 "Light Section" is the smallest of the three Mudge gang cars. It is built for six men or less.

We manufacture a complete line of motor cars, push cars, and trailers. Ask for descriptive literature.

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. • CHICAGO

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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Specialization

Serving but one industry .... as Fairmont does .... stimulates creative ideas improving the product while simultaneously lowering manufacturing costs. The invaluable experience gained through this concentration benefits equally the manufacturer and the purchaser, as witness of which is the "Performance on the Job" distinguishing Fairmont products. More dependability for a longer period of time .... greater safety for railroad men .... lower maintenance costs .... all are the practical result of this 18-year old policy of Fairmont.

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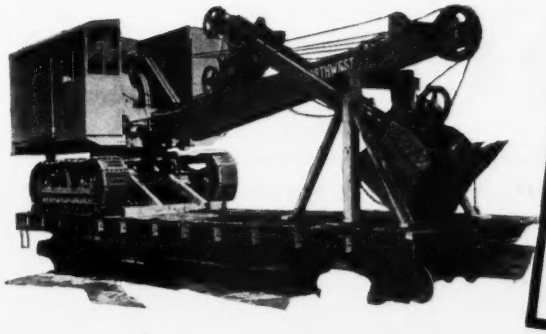
Electric current is supplied by the Jackson Portable Power Units, built in sizes suitable for operating sufficient tampers to meet your particular requirements. These units are readily handled by a few men and may be placed at any point along the roadway without special foundation.

The illustrations show both rock ballast and gravel ballast tamping with Jackson Electric Equipment.

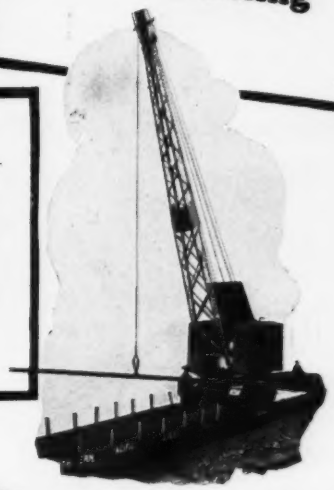
ELECTRIC TAMPER & EQUIPMENT CO.

80 E. JACKSON BLVD. CHICAGO, ILLINOIS



Can be loaded or unloaded under its own power on a standard flat car without dismantling

Can travel from car to car, working from the car

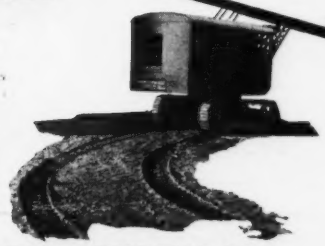


Because Northwest slows down either crawler to turn and does not block it, positive traction is maintained.

A Northwest goes where other machines falter

Rails or ties offer no obstruction.

Treads can't buckle and wedge between rollers



.... It's the railroaders' machine!

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines

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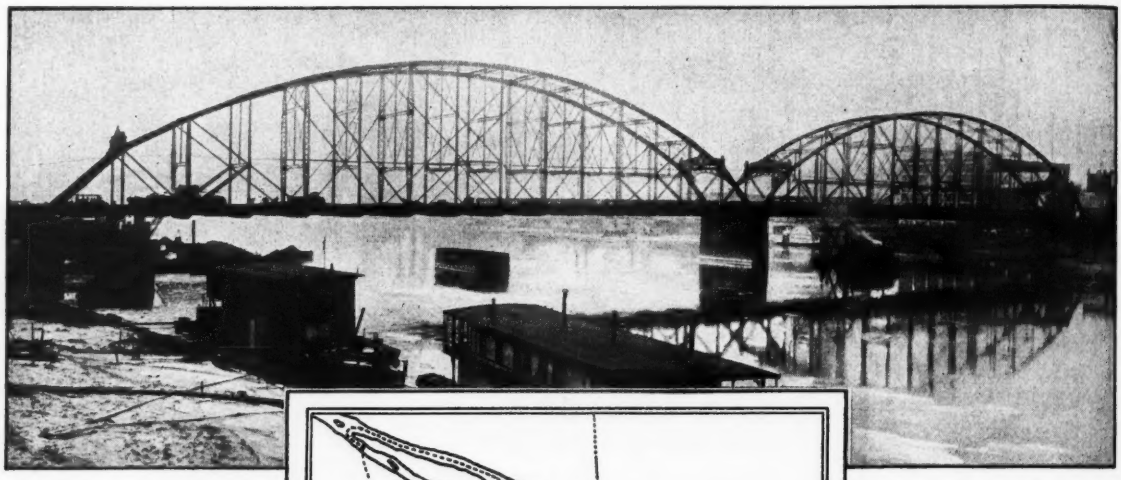
NORTHWEST

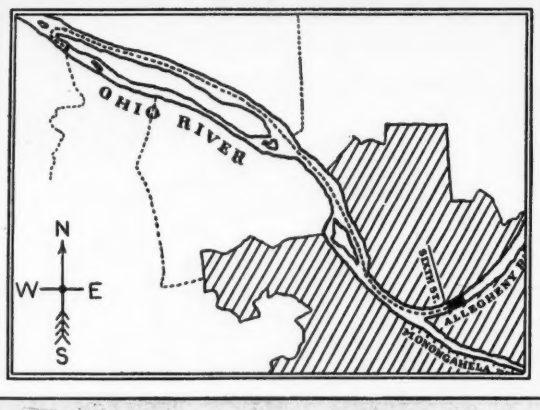
CRANES · SHOVELS CONVERTIBLE and DRAGLINES

Gasoline and Electric RE&M-5-Gray

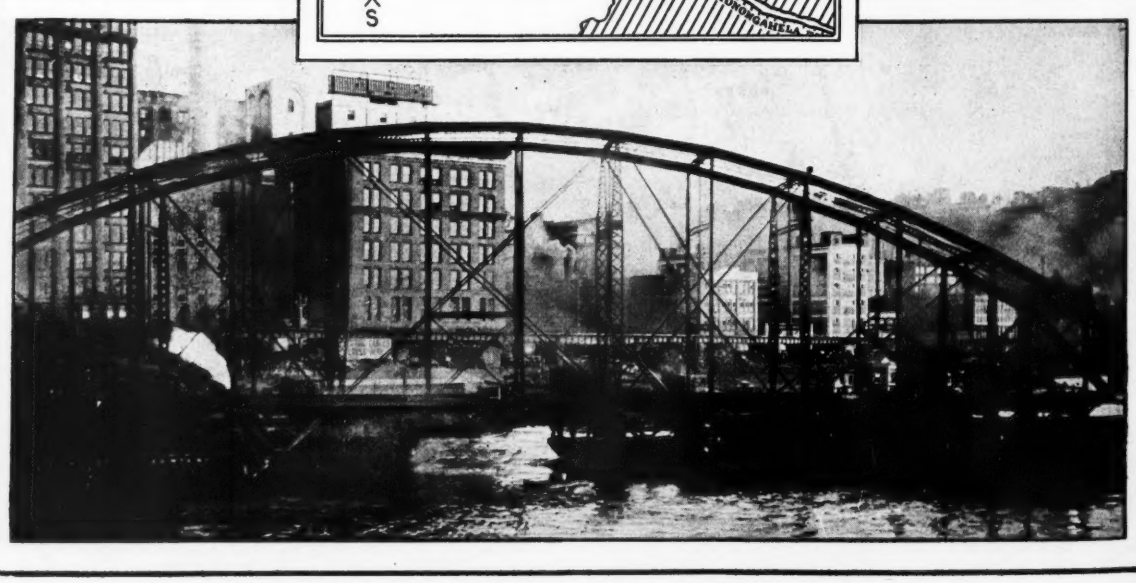
— Ferrying a



Above. The Sixth Street Bridge in its new location, 18 miles down the Ohio River.



Map showing course taken by barges moving the two spans of the Sixth Street Bridge.

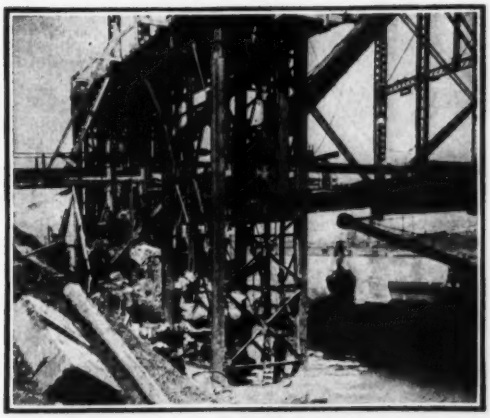


One of the spans of the Sixth Street Bridge floating on four steel barges bolted together in pairs, supported on "I" beams.

DU PONT
REG. U. S. PAT. OFF.

3200 ton Bridge

18 miles down the Ohio River



Showing how piers were sliced off with du Pont Dynamite to permit moving Sixth Street Bridge to new location.

PLUCKING a bridge 880 feet long and weighing 3200 tons from its moorings and moving it intact to a new location involved a feat never before attempted by any engineering company. The bridge is in two spans, each 440 feet long, 80 feet high and 44 feet wide, and each weighing 1600 tons.

The contract called for moving this bridge from 6th Street, Pittsburgh, about a mile down the Allegheny River, and from the junction of the Allegheny and the Ohio Rivers, 18 miles down the Ohio.

Giant jacks raised the bridge several feet so that the sides of the stone piers could be cut away. The two spans were then lowered onto four steel barges, bolted together in pairs, with heavy "I" beams fastened across each pair to support the bridge.

The piers from which the bridge was removed were cut away by blasting with du Pont Dynamite. This heavy stonework was sliced away as neatly as though done with a cold chisel. The nearby station for unloading coal, the big 12-story buildings close by, and auto parking fields near the bridge were not the least bit affected by this blasting.

Back of the Nation's engineering enterprises, great and small, are the preparing forces of du Pont Explosives and Explosives Service.

Concentrated in each stick of dynamite, in each blasting cap, in each accessory, are the results of 125 years of leadership in explosives manufacture.

E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department, WILMINGTON, DELAWARE

DU PONT
REG. U.S. PAT. OFF.

TRAFFIC-WORN RAIL ENDS RENEWED

Without Removal

Rebuild your battered rail ends with Teleweld—the process which builds up and surfaces rail ends smoother and tougher than new.

Setting Power Plant off the Track

Chipping off Laminated Metal Before Welding

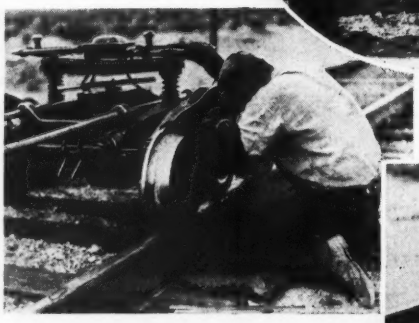
Welder at work half-mile from Power Plant

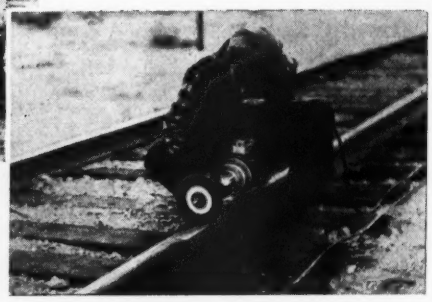
Rebuilds "A Mile at a Time"

Each Teleweld unit operates a half a mile in either direction, thus, rebuilding a full mile of track at one setting.

No Preheating Necessary

The Teleweld process confines the heat during application, permitting use of harder and tougher metal and obtaining greater depth of penetration.





Above—Grinding joint to a true surface

Right—Camphering joint after surface grinding

175,000 Teleweld Joints in Transcontinental Service many of them under severest traffic conditions.

A Teleweld representative will gladly explain in full detail.

San Francisco
952 Howard Street

Salt Lake City
Continental Bank Bldg.

ELECTRIC RAIL WELD SERVICE CORP.

Denver
2101 Blake Street

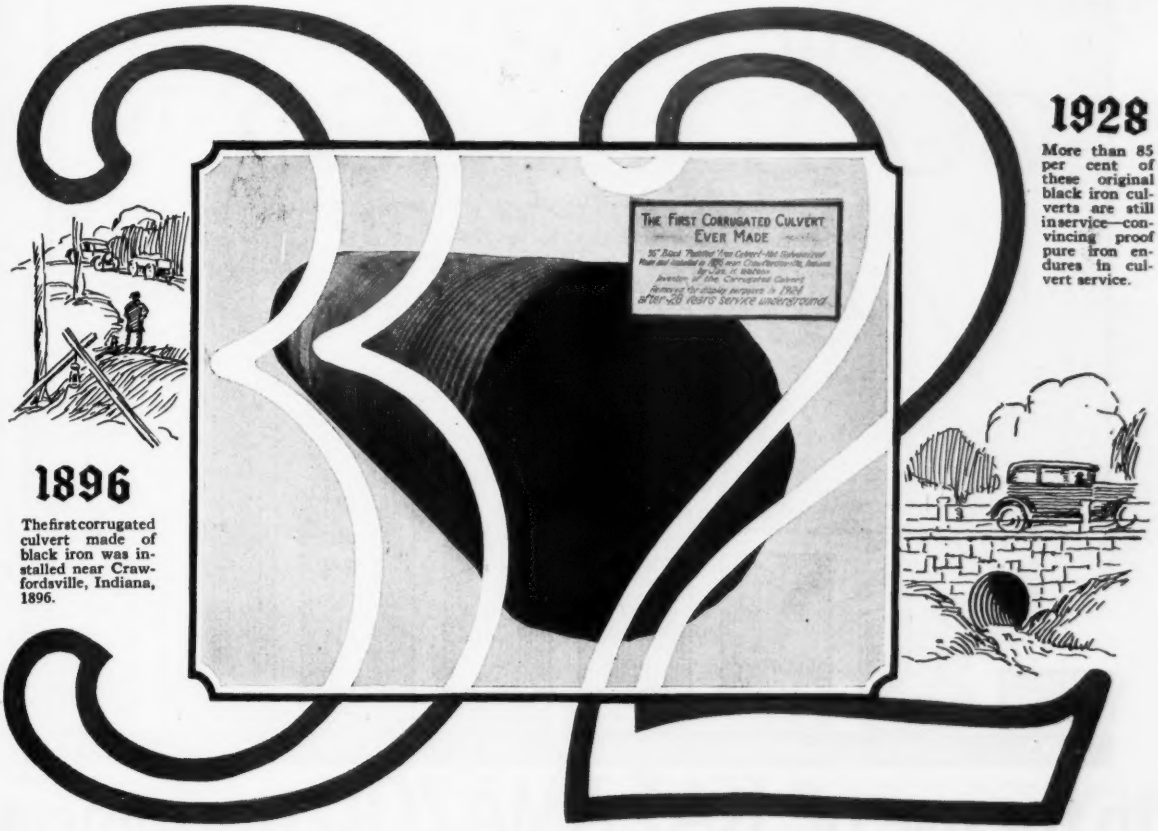
Spokane
Old Nat. Bank Bldg

RAILWAY EXCHANGE BUILDING, CHICAGO

Typical picture of rail ends showing low joints

Same rail ends rebuilt by Teleweld

and again the years repeat the message:


THE FIRST CORRUGATED CULVERT EVER MADE
Invention of the Corrugated Culvert
Armco 16-gage sections in 1924 after 28 years service underground

1928

More than 85 per cent of these original black iron culverts are still in service—convincing proof pure iron endures in culvert service.

1896

The first corrugated culvert made of black iron was installed near Crawfordsville, Indiana, 1896.

"For Safety and Economy—Flexibility and Pure Iron"

THIS month the corrugated iron culvert industry is 32 years old. Through these years much has been learned of drainage and its applications, and of field methods.

But more important than that, evidence has accumulated of the soundness of the judgment of that early pioneer, James H. Watson, in respect to both safety and economy in drainage construction.

For, since 1896, the corrugated iron pipe in the largest diameters has been proving to public and private officials, that it cannot crack and cannot be crushed by ordinary subsoil pressures. Watson's dream of safe underground construction has been realized.

Upon the introduction of Armco ingot iron in 1906 there was established, in addition, a new standard of durability. Durability, as Watson and his associates realized, in combination with flexibility, is the true basis of economy.

If you are now using flexible Armco pipe the evidence of 32 years confirms your judgment. But if not, why forego the benefits of safety and economy available to you in this sturdy, proven product?

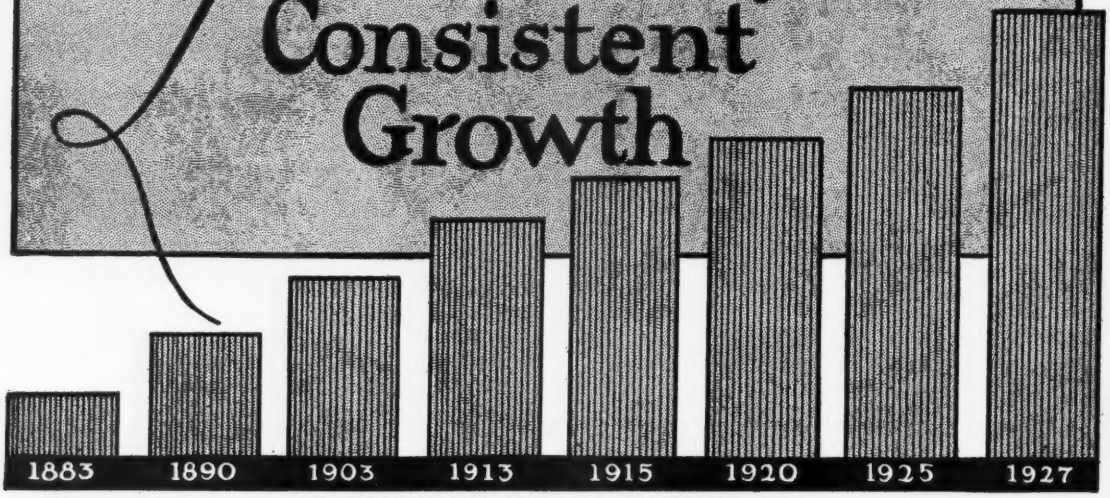
ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

ARMCO CULVERTS

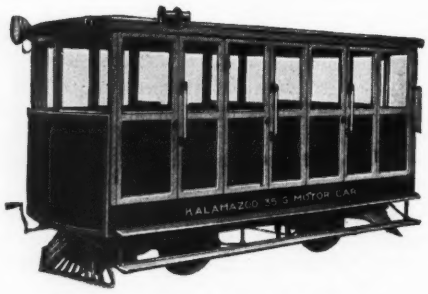
Predominant in use because predominant in quality

©1928, Armco Culvert Mfrs. Assn., Middletown, Ohio

There Must Be GOOD REASONS for this steady Consistent Growth



in the use of KALAMAZOO equipment



"Kalamazoo's" have always kept pace with the development and progress of modern railroading, with a complete line of hand and motor cars, and other maintenance equipment.

It has been because of the consistent and continuous Kalamazoo record of producing reliable, high-quality, labor-saving maintenance equipment.

"KALAMAZOO
Means Service to You"

KALAMAZOO RAILWAY SUPPLY CO.

Established 1883

KALAMAZOO, MICHIGAN

New York St. Louis New Orleans Spokane Portland, Ore. London Johannesburg Winnipeg Chicago
St. Paul Denver Seattle Havana Mexico City Vancouver Montreal

Buy your cement in these modern bags to avoid loss

THE BEST form of cement insurance is buying your material in Bates Multi-Wall Paper Bags, the modern containers which resist moisture and rough handling with 5 separate walls of tough, pliable paper.

Bates Bags not only protect your cement against sudden showers, warehouse moisture and loss through bag breakage or sifting; they eliminate much clerical work because they need not be returned for credit.

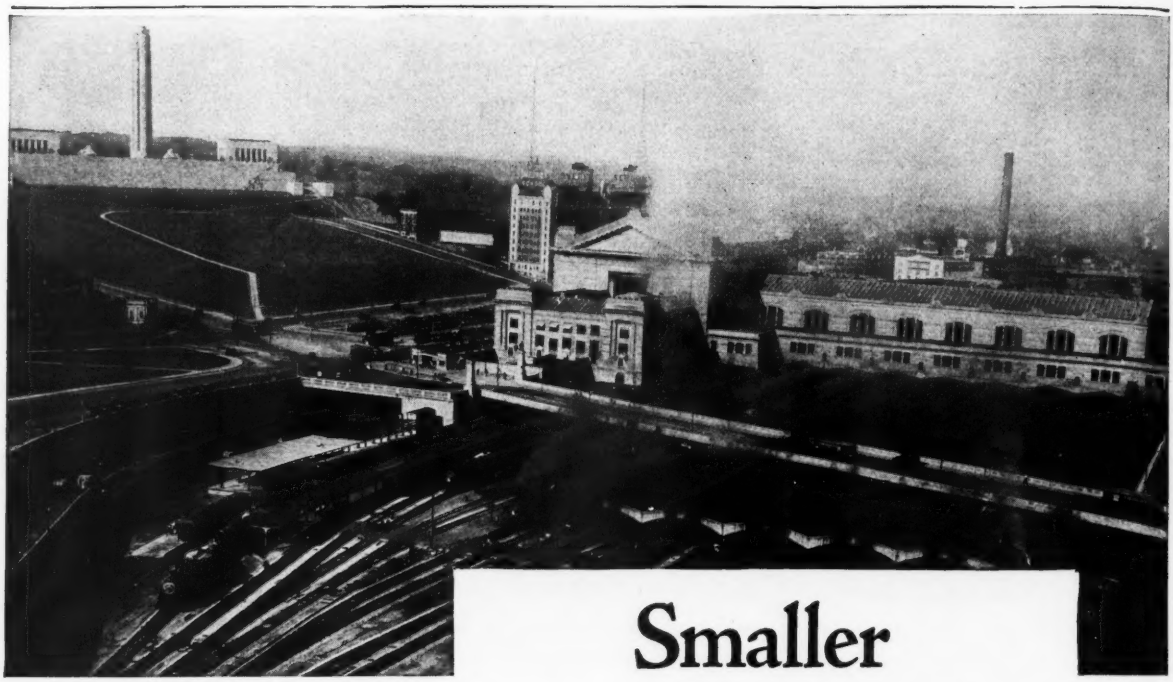
Buy in Bates Multi-Wall Paper Bags and put your cement stocks on a no-loss basis.

—no loss

BATES VALVE BAG CORPORATION
35 E. Wacker Drive, Chicago, Ill.

BATES *Multi-Wall* PAPER BAGS

Bates Multi-Wall Paper Bags are made by the Bates Valve Bag Corporation in 8 modern plants throughout the country



Smaller lumber yards

thanks to the railroads

GREAT PILES of lumber, covering acres of ground, were once a common sight. Lumber dealers who were forced to keep tremendous stocks on hand for deliveries were always slow and uncertain.

During the past six years these great piles have grown smaller steadily, until today dealers have four billion less board feet in stock. The estimated saving in capital investment alone is more than 600 million dollars.

This is but one example of the tremendous economies made possible by greater railroad efficiency. It has created a new era of business —the era of small inventories.

By supplying the oxwelding needs of a majority of the important railroads of the country, the Oxweld Railroad Service Company has contributed its share to the development of modern railroading. It is a railroad type of organization equipped to cooperate to the fullest extent with any railroad.

Oxweld Railroad Service

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
New York City: Carbide and Carbon Building
Chicago: Railway Exchange

Universal Pipe is the only cast iron pipe that does away with all pouring, calking, lead, lead substitutes, melting pots, ladles, furnaces, fuel and the rest of the paraphernalia required in making the ordinary pipe joint.

A Partial List of Railroads using Universal Pipe

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NEW YORK, NEW HAVEN & HARTFORD
CHICAGO, BURLINGTON AND QUINCY
LONG ISLAND
DELAWARE, LACKAWANNA & WESTERN
MOBILE & OHIO
CANADIAN PACIFIC RAILWAY
PENNSYLVANIA LINES
BOSTON & ALBANY
BOSTON & MAINE
CENTRAL VERMONT
LOUISVILLE & NASHVILLE
WHEELING & LAKE ERIE
INTERNATIONAL RAILWAYS OF CENTRAL AMERICA
TRUXILLO R. R. OF HONDURAS
TELA R. R. OF HONDURAS

Savings all along the line . . .

Experienced labor unnecessary—Wrenches the only tools

RAILROADS with an eye to highest efficiency prefer Universal Cast Iron Pipe for water supply, fire protection and other service where freedom from leakage is essential.

There is nothing to deteriorate, nothing to work loose in the Universal Pipe joint. All jointing materials and jointing equipment eliminated. Experienced labor unnecessary.

The hub and spigot ends, machined at slightly different tapers, are drawn into direct contact, forming a flexible joint that amply provides for expansion and contraction, vibration and uneven ground settlement. Curves laid with standard 6-foot lengths.

Universal Cast Iron Pipe is in great favor the country over because of its labor-saving simplicity and unfailing dependability. Every joint as permanently tight as the wall of the pipe itself. Let our nearest office show you how much easier, quicker and safer Universal Pipe really is.

UNIVERSAL CAST IRON PIPE

No bell holes to dig: No joints to calk

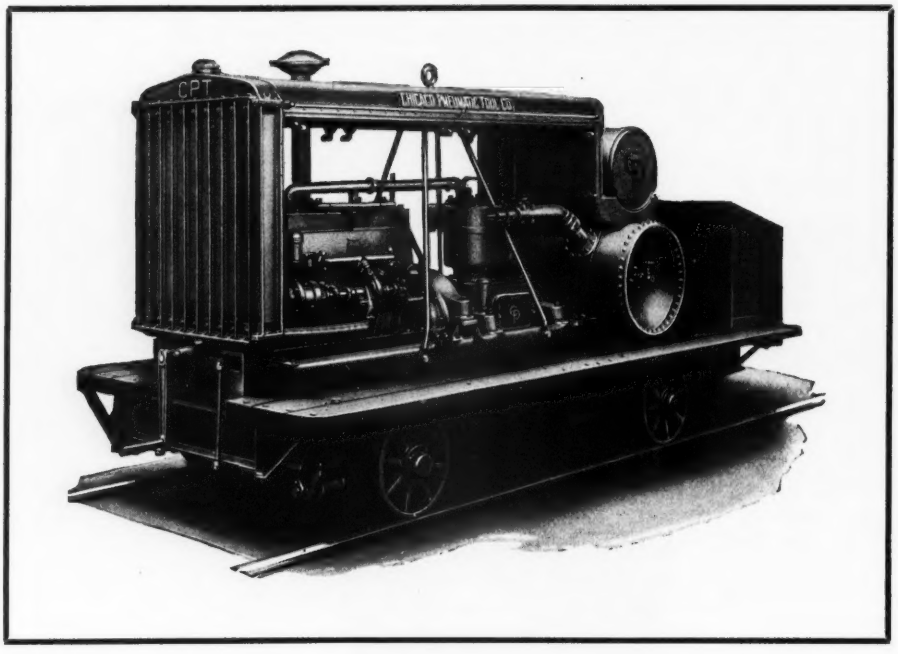
THE CENTRAL FOUNDRY COMPANY

Subsidiary of The Universal Pipe and Radiator Company

Graybar Building, 420 Lexington Avenue

Chicago Birmingham New York Dallas San Francisco

R-4



New

Ready to go—under its own power—to handle almost any railroad service job where compressed air is needed, the CP Self-Propelled Gasoline-Engine-Driven Compressor makes possible a new efficiency in railroad maintenance equipment. The standard CP Compressor with its famous Simplate Valve, Auto-Pneumatic Throttle and other exclusive features, is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels, a transverse towing winch and air-operated lifting jacks. The car is propelled at a speed of 12 to 18 miles per hour, depending upon the size. The compressor is furnished in sizes of 100, 160, 220 and 310 cubic feet per minute displacement. Bulletin No. 789 completely illustrates and describes this latest CP development and will be sent on request.

CHICAGO PNEUMATIC TOOL COMPANY

C-280

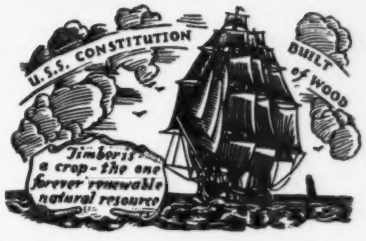
Railroad Department

6 East 44th St., New York **310 South Michigan Ave., Chicago**

Sales and Service Branches All Over the World

UNUSUAL SLANTS MAKE THE "N.L.C." *VITAL TO YOU*

NEW methods for cutting the cost of production are being established almost daily by the "N.L.C."...three letters which stand for the National Lumber Consultant. Today, as never before, getting facts—through specialization—through research—are vital to successful operation in this era of super-competition. The corps of experts characterized by the letters N. L. C. are thoroughly trained and experienced in the use of wood. Their daily contact with wood problems in every industry has resulted in an accumulation of experience within their ranks that can help you cut production costs by the right use of the right wood.



Whether your particular problem in the use of wood be based on a better or more efficient method of packing or crating your product—the proper specifications for a new building—the economical housing of your employees—upon the proper selection of the right raw material—the "N.L.C." can assist you materially.

The cost of the services of the "N.L.C." specialist to solve your particular problem is exactly—nothing! It entails no obligations.

A request on your letter-head will bring either additional information regarding this service, or a personal call from the "N.L.C."—as you desire.

NATIONAL

LUMBER

MANUFACTURERS ASSOCIATION

WASHINGTON, D. C.

NEW YORK, N. Y. *SAN FRANCISCO, CAL.* *INDIANAPOLIS, IND.* *DALLAS, TEX.*
CHICAGO, ILL. *MINNEAPOLIS, MINN.* *KANSAS CITY, MO.* *PORTLAND, ORE.*

AMERICAN STANDARD LUMBER FROM AMERICA'S BEST MILLS

Strenuous Service Demands Unusual Steel

. . Have you Given Full Consideration to Alloy Steel?

The very qualities that have given alloy steel its present standing in the field are the ones most needed in certain locomotive parts. In railroad service, toughness, strength and durability and resistance to shock and fatigue reflect themselves in increased operating efficiency, decreased time out of service and lower maintenance costs.

It is impossible to consider a program of reduced costs without a full study of alloy steel. In such a study our alloy engineers will gladly co-operate without cost or obligation.

Illinois Steel Company

General Offices: Chicago

ILLINOIS *Alloy* STEEL

"Sheffield 44"

This one reason alone-

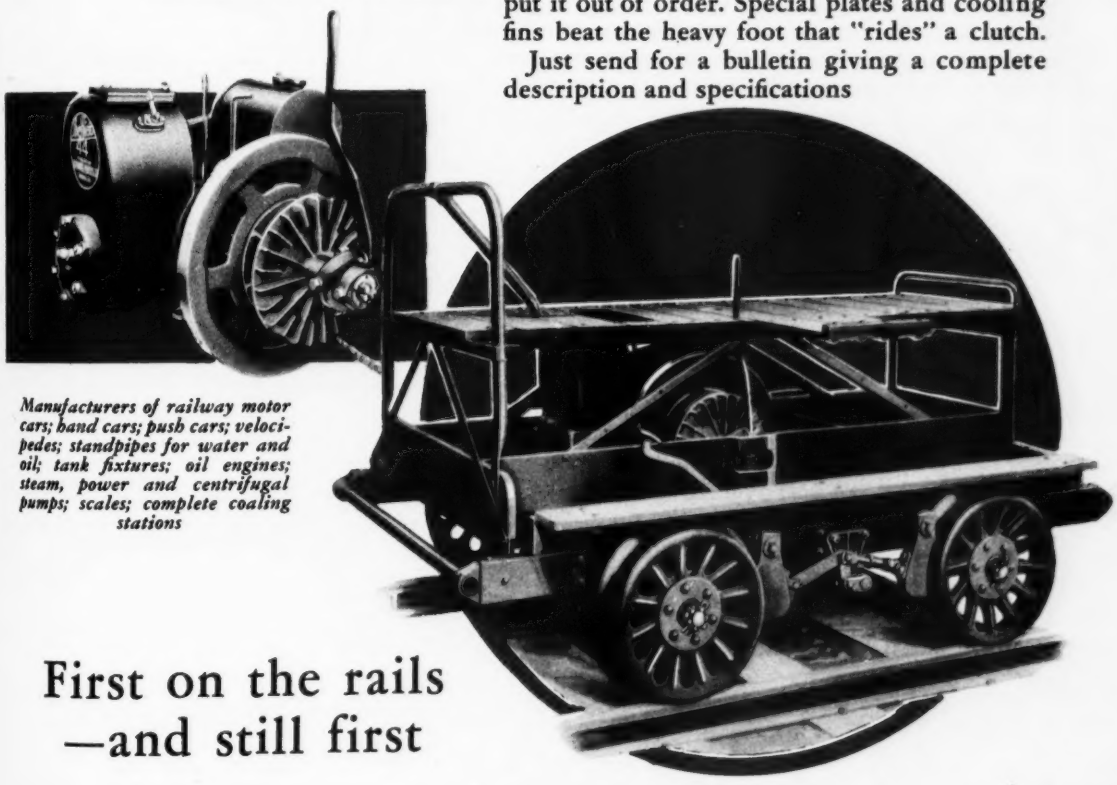
It's a great car—most railroad men know it is the best single-cylinder section car on the rails! It is built by a maker whose guarantee means something. Lightness is combined with strength—its huskiness makes no sacrifice to fuel and oil economy. These are all valid reasons for purchasing "Sheffield 44's." But one reason stands above them all.

You can put this car on a section with greater assurance that it will stay out of the repair shop. Frame, engine, and clutch transmission take abuse from men who do not know how to treat a car *right.*

The clutch cannot be burned out:

The clutch is built to "slip" when it should slip and rough handling cannot put it out of order. Special plates and cooling fins beat the heavy foot that "rides" a clutch.

Just send for a bulletin giving a complete description and specifications



Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

First on the rails
—and still first

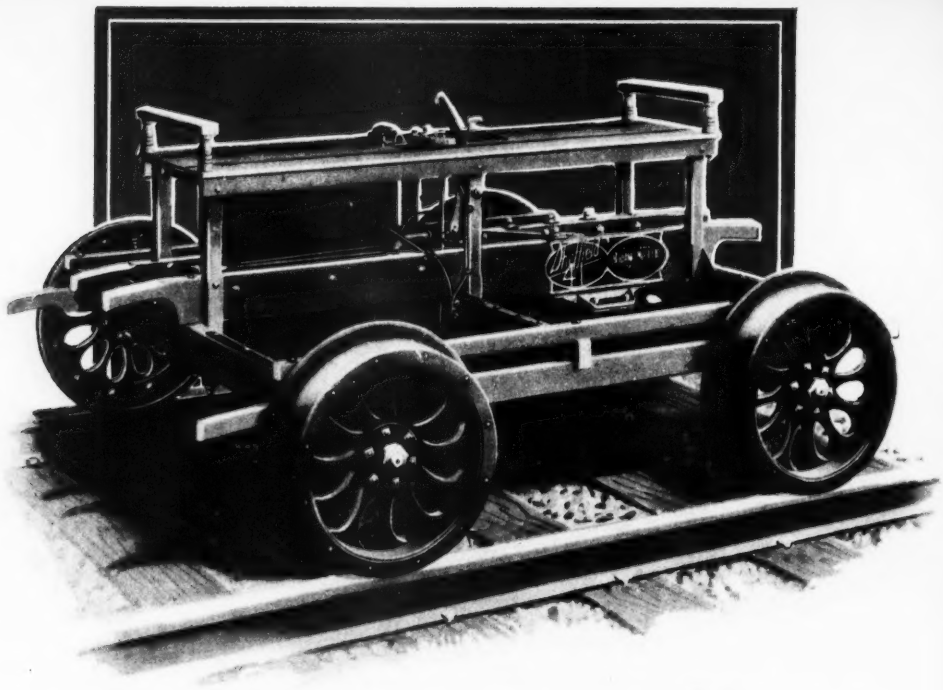
TIMKEN BEARING EQUIPPED

FAIRBANKS-MORSE

MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE *Motor Cars*



"Sheffield 41"

The dependable centerload car for roadmaster, linemen, supervisors, etc. A two-cylinder air-cooled engine—no cooling troubles. An automatic primer that gives easy quick starting. A car that is always ready for the road. A ten-year record to prove that it costs less than half as much to operate and maintain as any car for similar service. A fitting representative of a line of Sheffields operating on every important road in the United States. Complete information on request.

FAIRBANKS, MORSE & CO., *Chicago*

TIMKEN BEARING EQUIPPED

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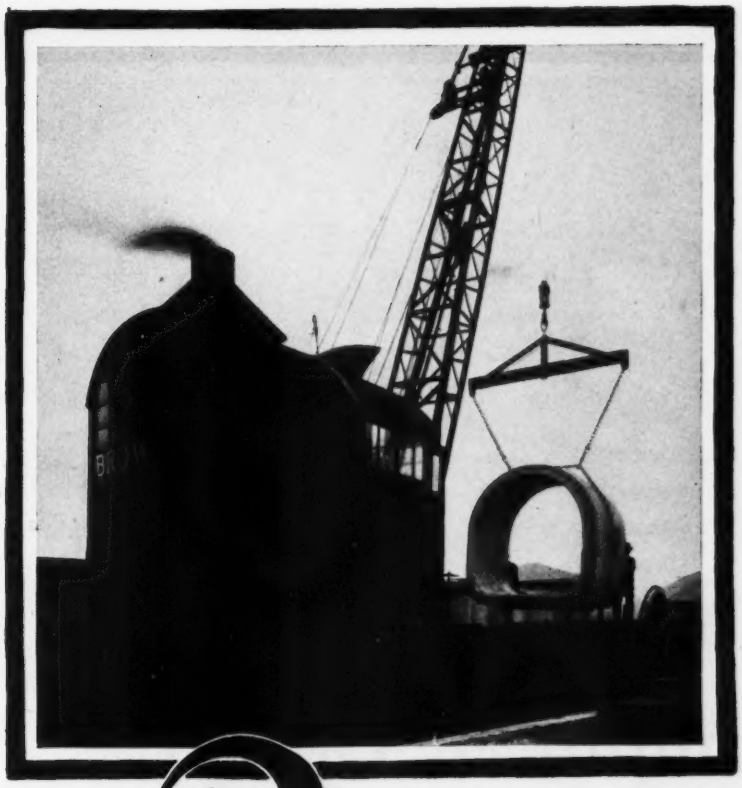
FAIRBANKS-MORSE MOTOR CARS



Precast Passageways

INSTALL passageways as you do culverts, thereby eliminating form work, field mixing and placing of concrete—all the inconvenience and delay incident to small monolithic structures?

Massey flat base pipe—of the same quality as the long standard Massey culvert pipe—makes possible this economy in construction of passageways. It is made in two standard sizes, 68 in. x 68 in. and 91 in. x 91 in.

Massey plants are so located as to serve you promptly and with minimum haul. Get an estimate on precast pipe for any pedestrian subways in this year's construction program.

MASSEY

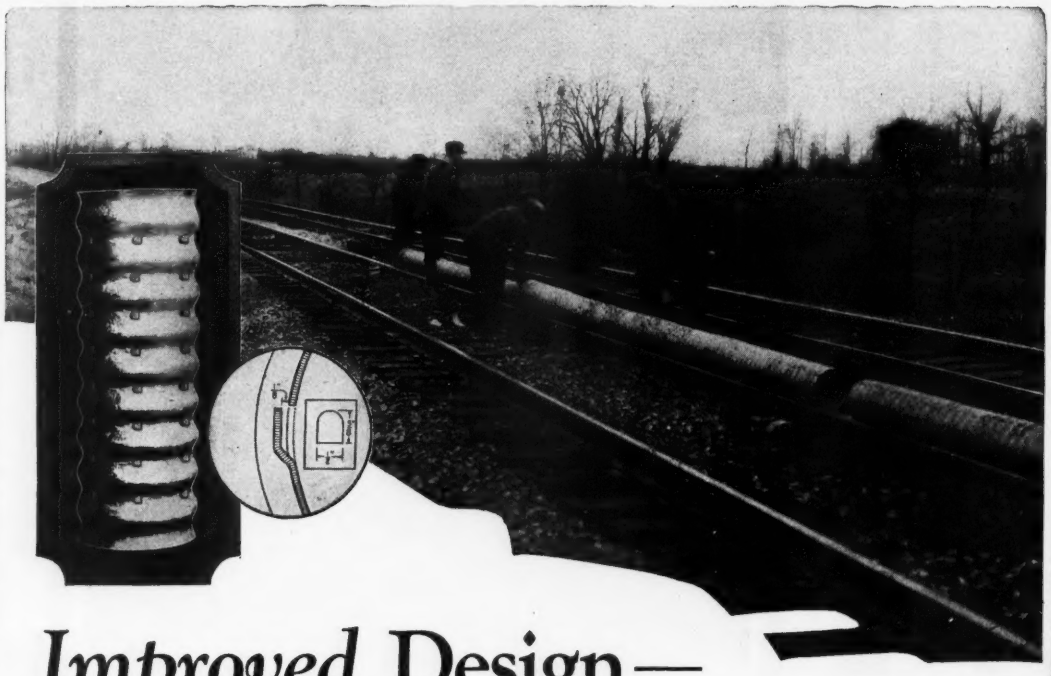
CONCRETE PRODUCTS CORPORATION

Peoples Gas Building, Chicago

Sales Offices: New York, Atlanta, Cincinnati, St. Louis, Los Angeles

Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

RE&M—5-Gray



Improved Design— *Improved* Material

TONCAN COPPER
Mo-lyb-den-um IRON

Following are the makers of Toncan Culverts. Write the nearest one:

Beall Pipe and Tank Corp. Portland, Ore.
The Berger Mfg. Co., of Mass. Boston, Mass.
The Berger Manufacturing Co. Dallas, Texas
The Berger Manufacturing Co. Jacksonville, Florida
The Berger Manufacturing Co. Minneapolis, Minn.
The Berger Manufacturing Co. Philadelphia, Pa.
The Berger Manufacturing Co. Roanoke, Virginia
The Canton Culvert & Silo Co. Canton, Ohio
The Firman L. Carswell Mfg. Co. Kansas City, Kansas
The Pedlar People, Limited Oshawa, Ontario, Canada
Superior Culvert & Flume Mfg. Co. Los Angeles, Oakland, Calif.
Tri-State Culvert Mfg. Co. Memphis, Tenn.
Wheat Culvert Company, Inc. Newport, Kentucky

YEARS and years of maintenance-free service is the story of Toncan Iron drains on the railroads.

Today this service is still further improved in two distinct ways.

Design has been radically bettered by the use of rows of outward-tongued perforations instead of usual holes. This provides highest drainage efficiency while retarding the entrance of dirt.

Not content with this, the material itself has been improved. By alloying the iron with molybdenum and copper a greater corrosion resistance has been developed. The new Toncan Iron drains will outlast even the existing Toncan Iron drains which have been famous for years for their corrosion-resisting qualities.

Even better service from drains is now available through this new development by the makers of Toncan Iron Drains. Ask about it.

CENTRAL ALLOY STEEL CORP.
Massillon, OHIO
World's Largest and Most Highly Specialized Alloy Steel Producers
Makers of Agathon Alloy Steels
Cleveland Detroit Chicago New York St. Louis
Syracuse Philadelphia Los Angeles Tulsa
Cincinnati San Francisco Seattle

TONCAN COPPER MO-LYB-DEN-UM IRON

THE McWILLIAMS MOLE

At last the costly and laborious task of cleaning ballast by hand or locomotive crane has been eliminated by the McWilliams Mole,—the ingeniously designed machine that automatically excavates and cleans ballast to an adjustable depth of 13 to 24 inches below top of ties—*clearing all trains while in operation.*

Every foot of ballast is thoroughly cleaned with no loss of stone. The saving in stone, as compared to other methods, more than pays for the cleaning operation—not to mention many other labor and time saving economies. Descriptive Bulletins mailed on request.

RAILWAY MAINTENANCE CORPORATION
Pittsburgh, Pennsylvania

Repeat Orders Prove Their Outstanding Merit

TIME-PROVED dependability is what you get when you purchase Woodings Track Tools. Many thousands are now and have been in use for years. As each year passes, a greatly increasing number is required—a sure indication of outstanding merit.

Woodings tools are economical because they cost less when length of life and service rendered are considered. The tools are properly tempered to provide maximum toughness and strength to perform the service for which they are intended. They are finished in a workmanlike manner because the most exacting standards of inspection prevail.

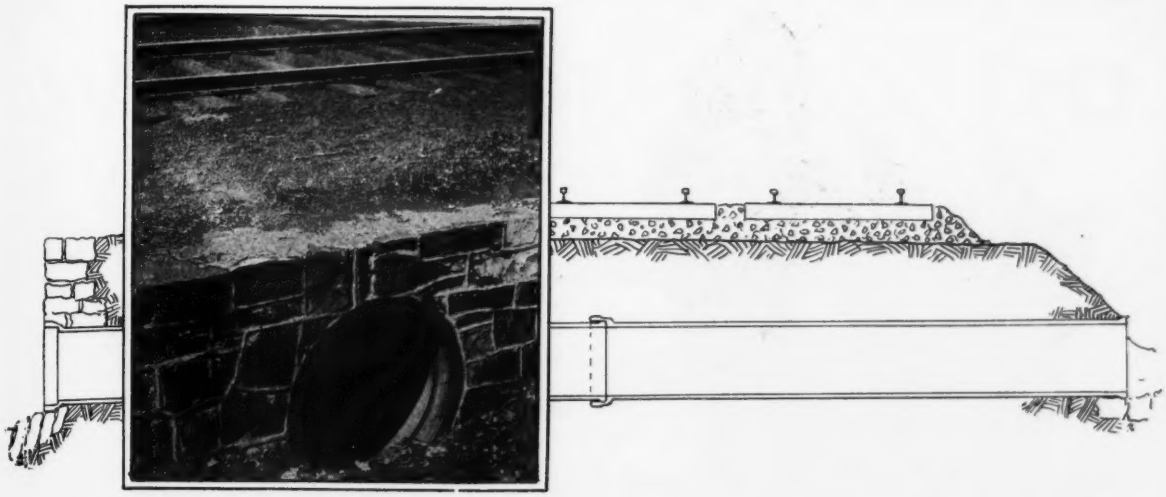
Woodings manufactures a complete line of high quality track tools, including tamping, pinch, claw and lining bars, picks, spike pullers, rail tongs, spike mauls, sledges and chisels—all of which meet A. R. E. A. specifications.

We respectfully solicit your consideration

Woodings Forge & Tool Co.

Works and General Sales Office
Verona, Pa.

WOODINGS
STANDARD TRACK TOOLS



Build for permanence with Cast Iron Culverts

A road bed is costly. When you build—you build for permanence.

To insure the permanence of the road bed, the permanence of the drainage system must be assured. Inferior culverts will not stand the test of time, the action of elements, the pounding of the road bed by heavy traffic and the chemical action of the drainage.

It is poor economy to install culverts whose life and dependability are doubtful, when cast iron culverts have proved their absolute dependability and desirability.

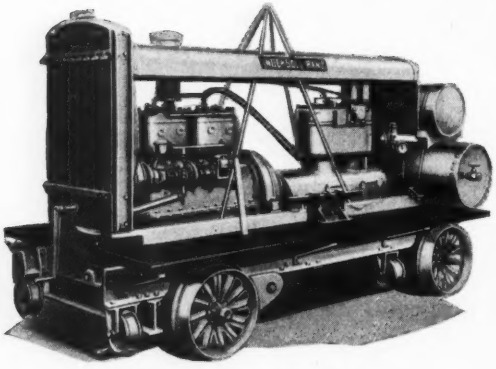
We have prepared a booklet called "Reducing Ultimate Culvert Costs" that will interest Maintenance of Way Engineers. Send for a copy.

United States Cast Iron Pipe and Foundry Company

General Offices:
Burlington, New Jersey

SALES OFFICES

Philadelphia: 1421 Chestnut St. *New York:* 71 Broadway
Chicago: 122 So. Michigan Blvd. *San Francisco:* 3rd & Market Sts.
Birmingham: 1st Ave. & 20th St. *Pittsburgh:* 6th & Smithfield Sts.
Buffalo: 957 East Ferry Street *Dallas:* Akard & Commerce Sts.
Cleveland: 1150 East 26th Street *Kansas City:* 13th & Locust Sts.
Minneapolis: 6th St. & Hennepin Ave.



The Ingersoll-Rand Tie Tamping Compressor is a complete power plant. Three sizes are available, having, respectively, 4-, 8- and 12-tool capacities. They operate all kinds of pneumatic tools used in rail-laying, bridge and building work.

Compressed Air Tie Tampers Make Sounder Roadbeds and Lower Costs

Records show that four men with I-R Air Tampers will tamp as much track as sixteen men with picks and bars. And they do a much better job in every respect. More ballast is tamped under each tie, and tamped harder, putting the track in better line and surface. Ballast can be tamped firmly around and under frogs, switches, cross-overs, and other places where it is impossible to strike a good blow with picks and bars.

Air-tamped roadbeds are smoother, safer, and more lasting. They have stood up under heavy, fast traffic for four and five years, requiring practically no maintenance work.

Ingersoll-Rand Company pioneered development of labor-aiding pneumatic equipment for tie tamping and rail-laying operation.

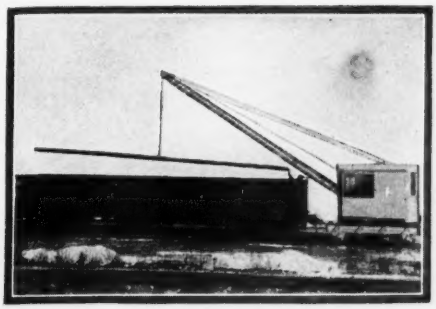
INGERSOLL-RAND COMPANY

11 BROADWAY . . . NEW YORK CITY

250-TT

Ingersoll-Rand

WHAT YOU CAN DO
with a Full-Revolving
BURRO CRANE

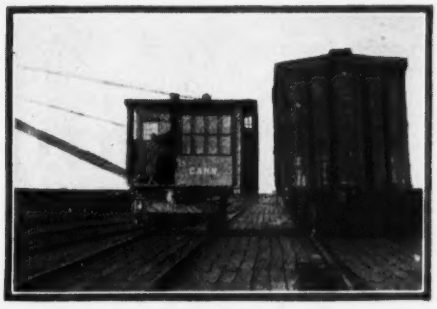


Burro Model 20 unloading 39 foot rail from gondola. The sides of this gondola are 4′ 8″ high, and the brake staff extends 6″ above the sides. Note that the crane is coupled to the car and is used to propel the car. Because of its drawbar pull this Burro Crane can effect tremendous savings by eliminating use of work train or locomotive in a great many cases.

HERE are twenty-four things you can do with a Burro Crane. How many hundreds of other operations connected with railway maintenance can be done more quickly with a Burro and at less cost, not even we can tell, for every day we hear of new uses to which the Burro is put.

Read over this list carefully. Then consider how many other things you can do with a Burro that will soon cause it to pay for itself. Here's the list:

Rail relaying
Double tracking
Loading and unloading rail
Laying new track
Loading crushed stone with clamshell
Cleaning cinder pits
Icing refrigerator cars
Handling rail in rail yard
Loading and unloading piles
Driving piles
Hoisting and setting trestle timbers
Handling frogs and crossings
Handling concrete and steel pipe
Setting up and dismantling signals
Handling iron and steel parts with magnet
Handling store department materials
Handling structural steel
Switching cars
Handling ballast with clamshell
Loading, unloading and handling bulk materials
Excavating with clamshell
Handling snow with clamshell
Hauling men and materials to work
Operating pneumatic and electric portable track tools



A Burro will do all of these things for you—and many more. Why not get further facts about Burro Cranes from us today? Complete Burro specifications sent free on request. Address

Cullen-Friestedt Co.

Main Office and Plant
1300 South Kilbourn Avenue
CHICAGO

Note how the 6′ 2″ tail swing of the Burro Model 20 enables the crane to swing completely around when used on double track roads without any possibility of the rear end of the revolving deck fouling the adjoining track.

Burro Model 20 has a travel speed of 1½ to 20 m. p. h. Capacity: 11,000 lbs.

L&N Railroad Crossing at Louisville, Ky.—an unusually bad angle, protected by Carey Elastite Track Pavement.

This Louisville Crossing *Welcomes* Traffic...

Carey Elastite Track Pavement consists of slabs about two inches thick, and sections of rail filler, both made of fibrous, asphaltic material that knits and heals under traffic. Set tightly in place, with ordinary tools and ordinary labor, the preformed slabs form a practically water-tight crossing but little affected by vehicular traffic. Its life depends upon track conditions.

THE above illustration gives some idea of the adaptability of Carey Elastite Track Pavement to unusual track conditions. Note the smooth surface of this skew crossing. And, because this unique material knits and heals under the constant hammering of traffic, it will remain smooth for a long period of service.

Carey Elastite Track Pavement is known for its economy and durability, under trying conditions, in all parts of the country. The growing popularity of this practical paving has made new low prices possible. Railroads will find Carey Elastite Track Pavement more of an economy now than ever before. Write for complete information.

THE PHILIP CAREY COMPANY

Lockland, Cincinnati, Ohio

Also manufacturers of Carey Elastite Bridge Flooring, Carey Elastite Water-proofing Protection, and Carey Elastite Trunking.

Carey Elastite

TRACK PAVEMENT

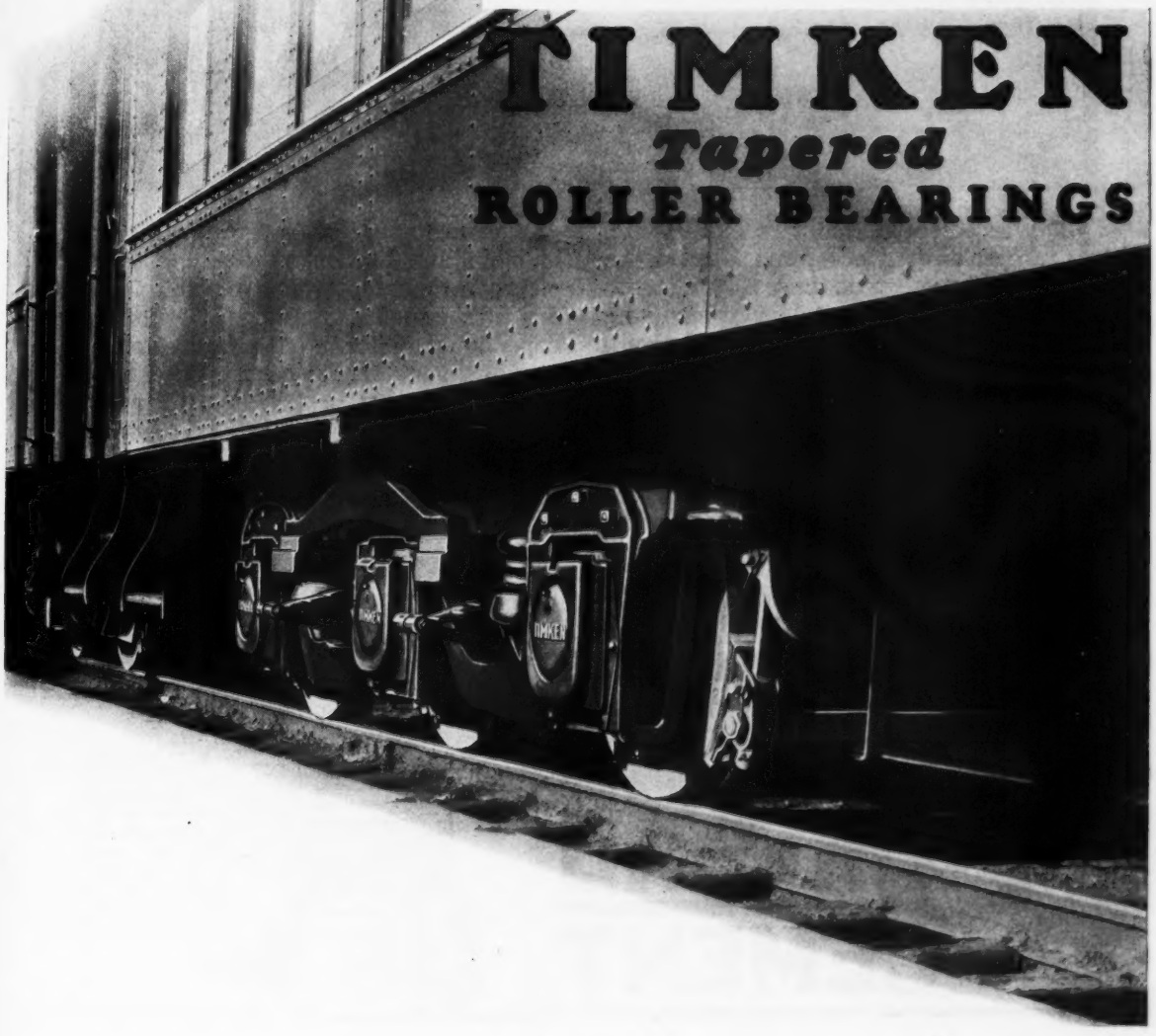
Anti-Friction Pro-Endurance

88% less starting resistance, savings of lubricant and power, elimination of hot boxes, and restfully smooth travel are part of the anti-friction phase of Timken Bearings for car journals.

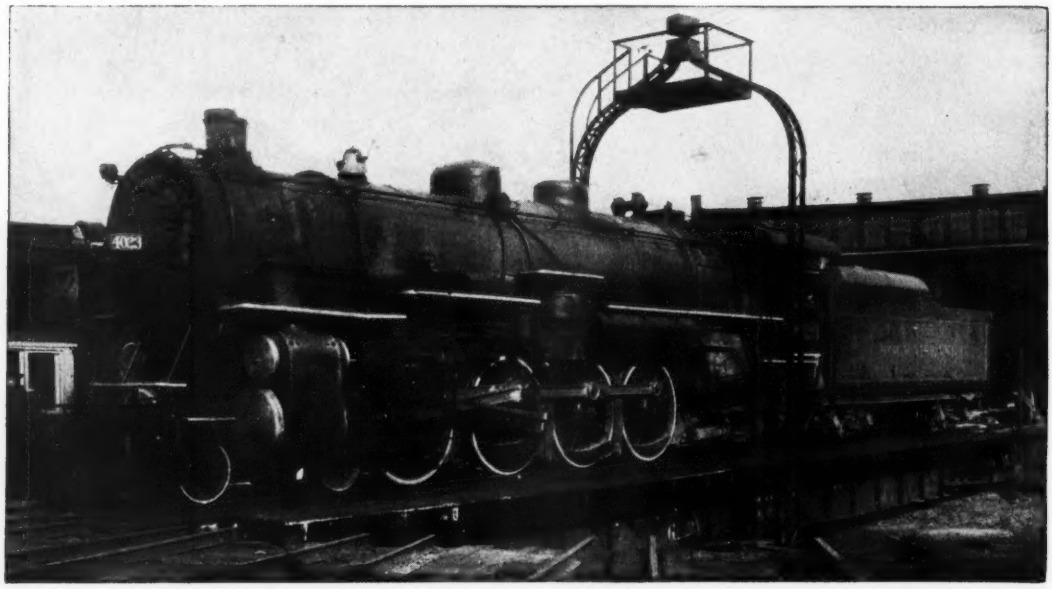
But what makes these bearings the *railroad* anti-friction bearings is their full thrust-radial capacity, greater load carrying area—their invincible endurance which wipes out most journal maintenance items.

Timken success against friction *and all other forms of wear* is made possible only by the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO



New Concrete Base Placed Late Saturday.... Turntable Back In Service Early Monday



IT was essential that this Rock Island turntable at Herington, Kansas, be available for use at all times. That's why Quikard Cement was used for constructing the new concrete base. The job was completed Saturday evening. Early Monday morning, the 80-ton steel turntable was put back in service. Such performance can be depended on with Quikard Cement—a true Portland Cement that develops 28-day strength in 24 hours!

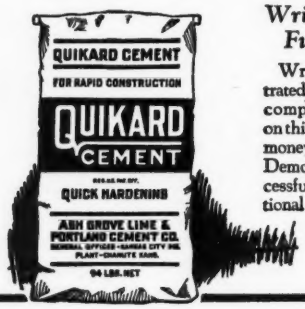
Quikard requires no admixtures or accelerators. Mixed in standard proportions, it attains this tremendous early strength—and, in addition, develops increased strength thereafter. It not only meets U. S. Govt. and A. S. T. M. standard specifications for Portland Cement, but exceeds all strength requirements.

Quikard is *not* quick-setting. It takes its initial and final set normally, allowing plenty of time for proper mixing, placing and finishing. It is plastic, easily finished, dependably uniform. It produces an exceptionally waterproof concrete that forms a perfect bond with new or old Portland Cement concrete.

Quikard affords you *all* these advantages. Its efficiency and dependability have been proved beyond question on important projects throughout this territory. It will save you time, labor and money. Use it for rapid construction!

Produced Only by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
610 Grand Avenue Temple, KANSAS CITY, MO.

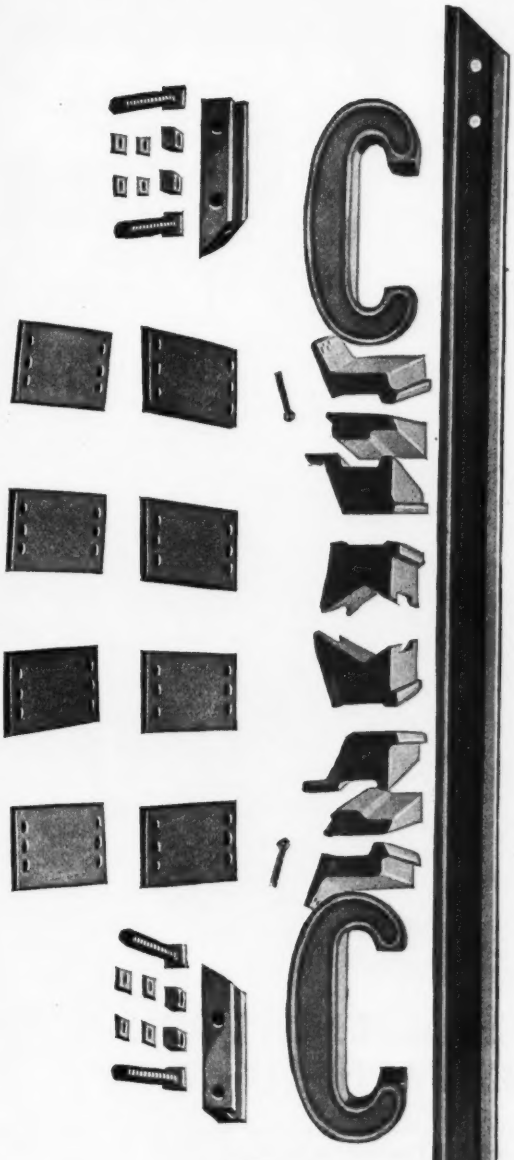
QUIKARD CEMENT



Write for Full Details

Write today for illustrated literature giving complete information on this proven time and money-saving cement. Demonstrates its successful use on additional important jobs.

10



39 Reasons Why You Should use a One Piece Guard Rail

There are thirty-nine parts in a standard open hearth guard rail installation used today under heavy traffic conditions—thirty-nine parts to be maintained and replaced when broken—thirty-nine parts to be carried in inventories and get mixed up in your stores department.

The Q&C Manganese One Piece Guard Rail solves the problem. There is only one piece, which is quickly handled and easily installed.

Made of full Manganese steel with the latest arch design, assuring long life with practically no maintenance.

The Q & C Manganese One Piece Guard Rail is made to fit all tee sections of rails in various lengths. We are also prepared to furnish a guard rail higher than the running rail when specified.

Our Engineering Department will gladly submit blue prints and detailed information for your local requirements.

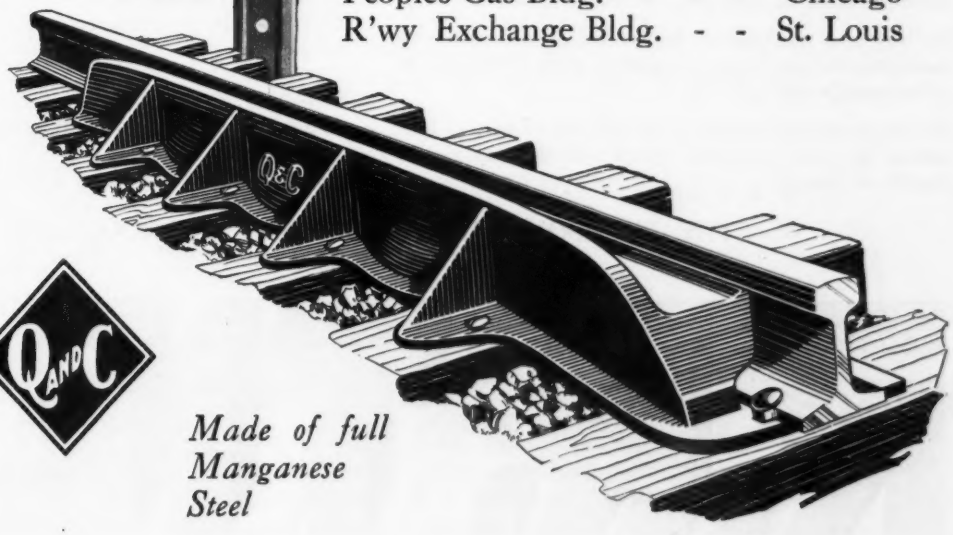
Specify Q & C Manganese One Piece Guard rails in your requisitions. They are more efficient and economical.

The Q&C Company

90 West St., New York

Peoples Gas Bldg. - - - Chicago

R'wy Exchange Bldg. - - St. Louis



Q AND C

Made of full Manganese Steel

KREOLITE

LIFE OF TREATED TIMBER DEPENDS UPON CHARACTER OF PRESERVATIVE USED

In order to insure the purchaser of a pure and uniform product, *we distill all of our own creosote oil.*

By our own method of distillation, it is possible to insure to the purchaser a uniform, pure Creosote Oil of any grade desired.

We have treated hundreds of millions of feet of timber in the past seventeen years without a single instance of decay.

Enormous stocks of Railroad Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked, stacked, and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill. (East St. Louis).

We specialize in framing timbers to your plan before treatment.

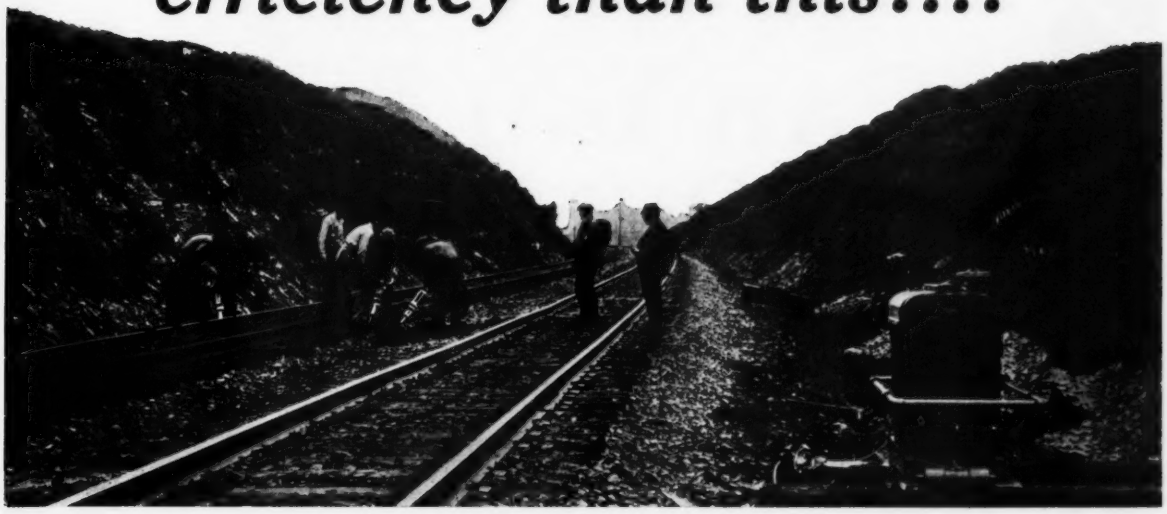
Quick shipment on short notice.

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

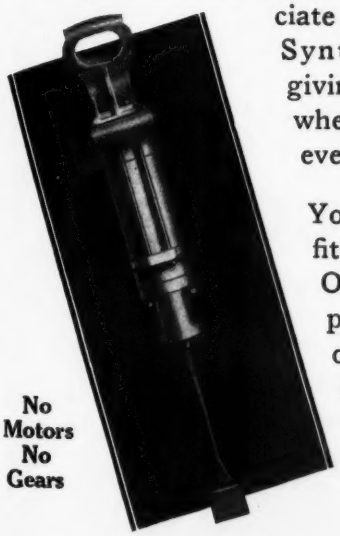
Branches in All Large Cities

R.R. TIES

There is no greater efficiency than this....



RAILROAD men who use Syntron Tie Tampers and the Syntron Power Unit know what it means to have a firm, solid road-bed tamped with utmost efficiency at less than half the cost of hand tamping and in less than half the time. They appreciate the fact that the Syntron Outfit is giving satisfaction wherever and whenever used.



No Motors No Gears

You, too, can benefit with the Syntron Outfit. It has a power unit that is one-fifth as heavy in weight as the ordinary unit, is easily moved, rides on a single rail, rests on the shoulder of the track and drives a number of portable electrical tools.

A feature of the Syntron Outfit is its extreme simplicity, having no motor to burn out, no gears to strip, nothing to get out of order. Only one moving part.

Investigate this efficient outfit now. Send for complete descriptive literature, proving economy in ballast work and road maintenance. Address

Dept. R-5

SYNTRON COMPANY

Lexington Avenue Pittsburgh, Pa.

SYNTRON

Electric Tie Tampers

Can You Tell the Difference

between a cheap fence and a good one?

FENCES that look much alike 50 feet away are often found to be radically different on close inspection. The practised eye takes in these differences at a glance. The high-grade fence has full-size posts and wire, posts set at proper depth in solid concrete, gradually formed links, uniform barbing, secure bracing and trussing, perfect alignment — many identifying marks of substantial construction.

The cheap fence, likewise is easily recognized. It betrays its weaknesses the day of its erection and proves its false economy by an untimely end. There's only one way to make a real saving on fence — buy on the basis of per-year cost.

Call a Cyclone Representative

Make a study of fence and learn the difference between a cheap fence and a good one. Consult a Cyclone-trained representative. He knows fence from every angle. He has helped to manufacture it in Cyclone plants, and has helped to erect it on the job. He comes equipped with long experience and a fund of knowledge that will enable him to grasp your fence problems quickly and advise you intelligently.

Without obligation, write, phone or wire nearest offices and have a Cyclone representative call.

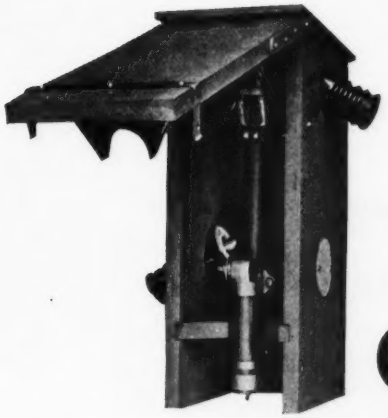
Cyclone Fence

REG. U.S. PAT. OFF.

CYCLONE FENCE COMPANY *Main offices: Waukegan, Ill.*
Works and Offices: North Chicago, Ill., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas
Pacific Coast Distributors: Standard Fence Co., Oakland, Calif., Northwest Fence & Wire Works, Portland, Oregon.
Direct Factory Branches in all Principal Cities.

Fencing for residences, estates, schools, playgrounds, factories, property of all kinds.

© C. F. Co., 1928



Only CYPRESS will serve for Matthews switch boxes

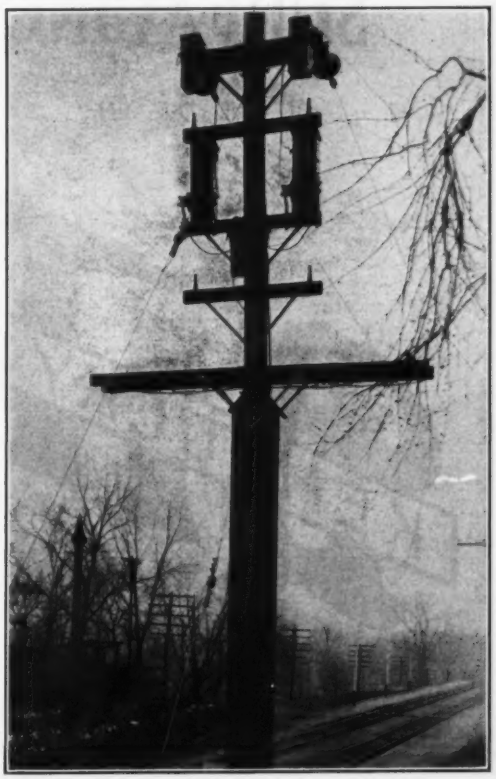
SWITCH boxes lead a hard life. They get little rest in their battle against the weather. So they must be built of wood that moisture doesn't bother.

Because dependability is the first, last and foremost consideration in the products they manufacture, the W. N. Matthews Corporation of St. Louis uses Tidewater Red Cypress in all of its switch boxes.

This large manufacturer has found that Tidewater Red Cypress resists moisture, fights off rot, is easy to fabricate, permits fine workmanship, and finishes smoothly.

Railroads are using more and more of this Wood Eternal each year. They employ it for passenger station construction, freight sheds, warehouses, platforms, conduits, water tanks, cars, fencing, and every other place where upkeep must be cut down.

Complete information on this long-lived wood will be sent free on your request. Write to Southern Cypress Manufacturers Association, Dept. R E 5, Jacksonville, Florida.

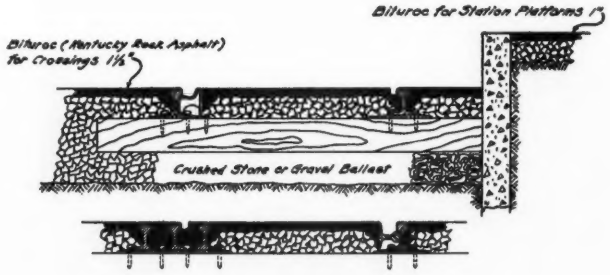


Matthews Fuswitches for transformer protection on automatic train control system. Above is a type HQ Matthews Fuswitch in a box built of durable Tidewater Red Cypress.

Specify TIDEWATER RED CYPRESS

THE WOOD ETERNAL

BITUROC
KENTUCKY ROCK ASPHALT
TRADE MARK



Typical section of Bituroc crossing
—and station platform—

SURFACING

BITUROC
KENTUCKY ROCK ASPHALT

MAINTENANCE

BITUROC Shipped in bulk ready to apply by section foremen
Does not deteriorate in stock

OUR FIELD MEN WILL BE GLAD TO ASSIST
YOU WITH ANY INSTALLATIONS OF BITUROC

Ohio Valley Rock Asphalt Co.

(INCORPORATED)

STARKS BLDG. LOUISVILLE, KY.

BITUROC
KENTUCKY ROCK ASPHALT
TRADE MARK

The name to look for on Steel

Because—it represents years of conscientious effort to give steel users better products—it represents control of manufacture from the mining of the ore to the finished product—it represents the work of experienced metallurgists, the pride of skilled workmen in their craft—it represents a friendly spirit of service and cooperation. Carnegie Rails and high carbon, oil quenched Angle Bars bear this name. It guarantees your satisfaction.

Let us quote on your next requirements.

Carnegie Steel Company

General Offices: Carnegie Building

PITTSBURGH, PENNA.

1911

"Casey Jones"
REG U.S. PAT OFF

A Complete Line of Motor Cars and Equipment for Railway Service

Casey Jones 551 - - - - Heavy Duty Motor Car
CLASS A -- 4 TO 150 MEN WITH TRAILERS--22 H. P. FOR ALL HEAVY DUTY SERVICE.

Casey Jones 523 - - - Heavy Duty Section Car
CLASS BB -- 2 TO 60 MEN WITH TRAILERS--8 H. P. FOR HEAVY DUTY SECTION SERVICE.

Casey Jones 521 Standard Section Motor Car
CLASS B -- 2 TO 30 MEN WITH TRAILERS--6 H. P. FOR STANDARD SECTION SERVICE.

Casey Jones 531 - Safety First Inspection Car
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Casey Jones 555 Official Inspection Motor Car
ENCLOSED TOP--FOR OFFICIAL INSPECTION AND EXPRESS SERVICE.

Casey Jones 552 - - - Heavy Duty Car Trailer
BUILT FOR HEAVY DUTY--SAFE TRANSPORTATION FOR LARGE GANGS.

Casey Jones 500 - - - - - Push Car and Trailer
IMPROVED CONSTRUCTION--EQUALLY EFFICIENT AS MODERN MOTOR CAR.

Casey Jones - - Standard Four 4-H.P. Engine
A LIGHT AND POWERFUL ENGINE FOR SMALL INSPECTION CARS.

Casey Jones - - - Standard Six 6-H.P. Engine
THE MOST ECONOMICAL AND EFFICIENT SECTION CAR ENGINE.

Casey Jones - - Standard Eight 8-H.P. Engine
THE MASTER MOTOR CAR ENGINE WITH PLENTY OF POWER FOR LARGE GANGS.

Casey Jones - - Recognized Standard of Value

WRITE FOR ENGINEERING DATA
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NORTHWESTERN MOTOR COMPANY
Eau Claire ~ Wisconsin

We knew we made good shovels but

It took a fellow from Beaumont, Texas, to tell us just how good he considered O. AMES.

He writes:—

"—your shovels are all well built, and made from the best of steel. I have made knife blades and plane bits out of the blades of your shovels."

Even though you may not care to whittle with O. AMES Shovels, figure out the wear resisting qualities of shovel steel strong enough for jackknives. Then specify O. AMES on the toughest shovel job you have. It means real shovel economy for you.

1874

O.AMES SHOVELS

SHOVELS-SPADES-SCOOPS

At good supply houses everywhere

AMES SHOVEL AND TOOL CO. - - Ames Bldg., Boston

Owners of Oliver Ames & Sons Corp., North Easton, Mass. Est. 1774

Makers of Old Glory, Liberty and Victory Brands.

A Necessary Ally of Tie Preservation

THE IMPROVED LUNDIE TIE PLATE

TIE preservation and Lundie Tie Plates are allied successfully in prolonging the life of ties in track—one preventing decay, the other preventing mechanical destruction.

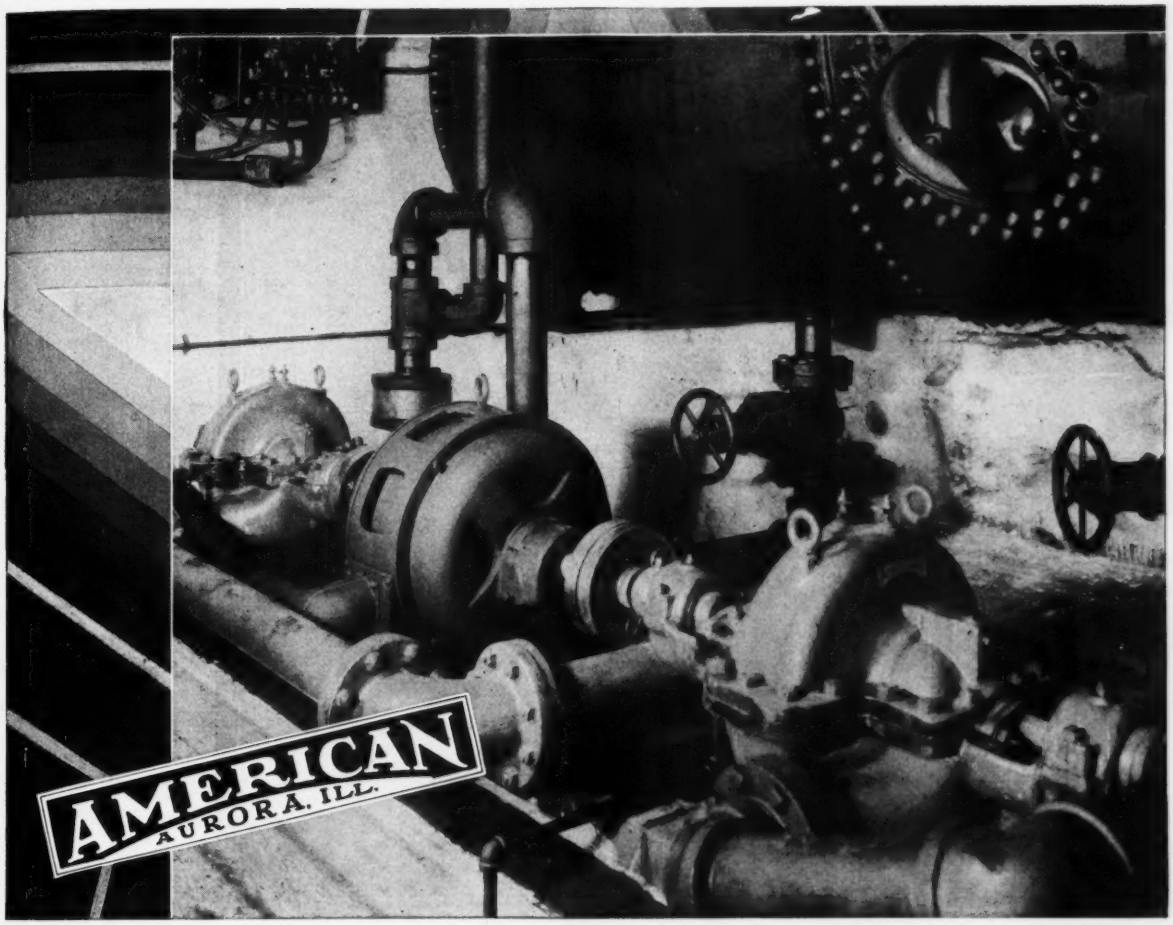
Tie preservation remains effective only as long as moisture is entirely excluded from below the depth of penetration of the preservative. This can only be attained by the use of a tie plate, that does not cut or wedge into the wood fibre.

Numerous roads have Lundie Tie Plates in service 10 and 12 years under heavy traffic. Thorough inspection of these ties gives positive evidence that they are still in excellent condition with no cutting or mechanical wear and not the slightest indication of plate movement on the ties.

These money saving results are made possible because Lundie Tie Plates are demonstrating their ability to absolutely hold gauge with complete elimination of destructive cutting of wood fibres. They assure the maximum return on your investment in treated ties.

The Lundie Engineering Corporation
285 Madison Avenue, New York
166 West Jackson Boulevard, Chicago

LUNDIE TIE PLATE



"AMERICAN" Pumps for Hydraulic Elevator Service

Branch Offices:

Chicago, Ill.
1615 First. Nat. Bank Bldg.

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Room 523—185 Broadway

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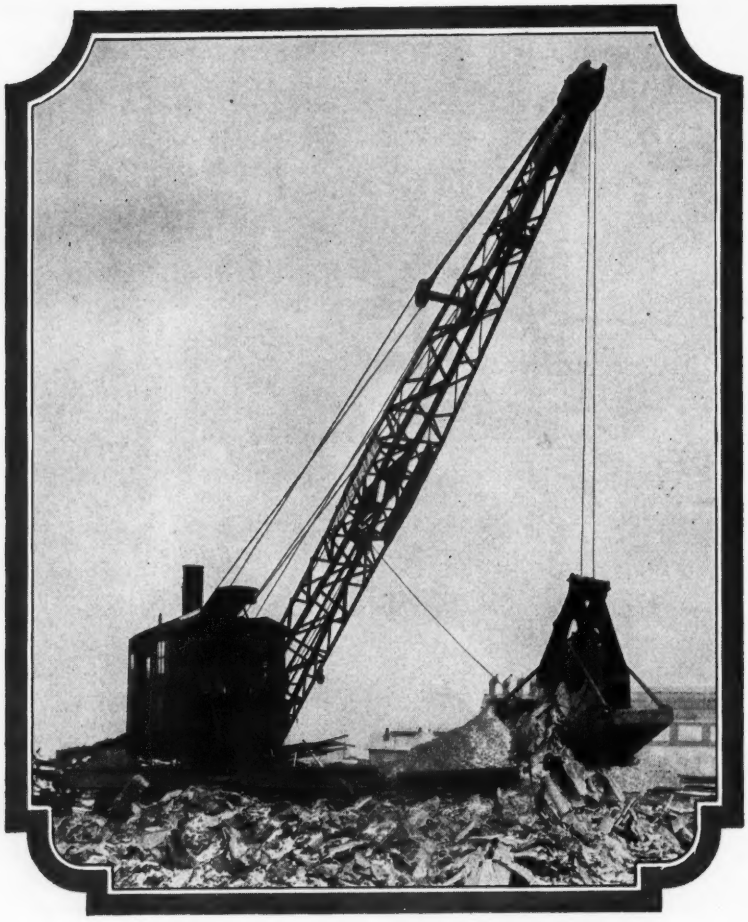
"AMERICAN" centrifugal pumps are standard equipment for many industrial uses. The installation above was made in the Philadelphia and Reading R. R. Company's freight house in Philadelphia. The two pumps, mounted on one base with a motor between, operate in series, the unit being used to activate a hydraulic elevator.

The unit is designed to have a capacity of 225 G. P. M. when operating against a total working-pressure of 200 lbs. per square inch, at 1750 R. P. M.

The motor used is one of 50-H. P.

THE AMERICAN WELL WORKS

General Offices AURORA, ILLINOIS *and Factory*



Save 50% Handling Lumpy Materials

Many companies are paying at least double what they need to for unloading lumpy materials from cars and for handling it in and out of storage. This is proved by records where Industrial Brownhoist cranes are handling coal, ore, limestone, coke and similar materials at less than half the cost of former methods.

Industrial Brownhoists are built on crawlers or railroad trucks and in many different capacity sizes; the average cost of operation being from twenty to thirty dollars a day. This includes all operating costs, depreciation and interest on the investment. For this amount you can get the equivalent in output of 20 to 40 men.

You can readily figure the saving from this kind of handling. There is an Industrial Brownhoist for your job which will do all kinds of bucket, hook or magnet work. Our nearby representative will be glad to go over your handling costs with you at your convenience.

Industrial Brownhoist Corporation
General Offices: Cleveland, Ohio.
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, St. Louis, San Francisco, New Orleans, Bay City, Mich.

INDUSTRIAL BROWNHOIST

METALWELD WORTHINGTON
M-W

1 **Laidlaw Feather Valves**—Patented — consisting of double strip steel, with forged steel valve seat. Lowest replacement cost of any valve made. Over 750,000 of these valves in use.

2 **Force Feed Lubrication**—by direct plunger pump on crank shaft. Positive oil feed to all main, connecting rod bearings and wrist pins.

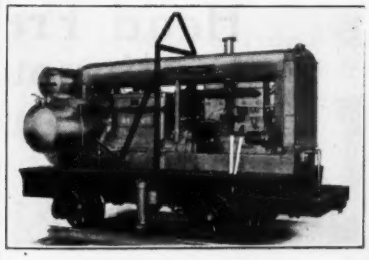
3 **Forged Counterbalanced Crank Shaft**—45 per cent. carbon steel; extra large main and rod bearings. No vibration.

4 **Cooling System** — Extra large water jackets running from top to bottom of piston travel. Water circulation by direct-driven pump on gasoline engine.

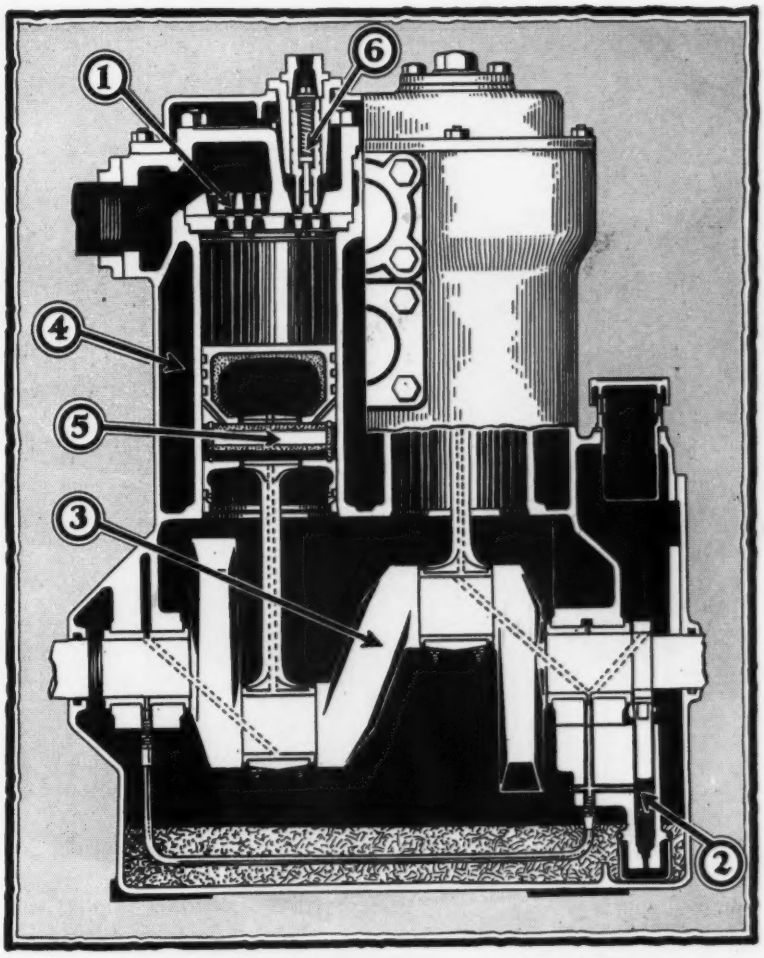
5 **Four Ring Auto-Type Pistons** with full floating wrist pin. Extra large oil reservoir and oil baffle plates at bottom of piston travel.

6 **Bronze Piston Type Unloader** with piston rings. Insures perfect seal of inlet valves during unloading period.

Other features include Automatic Engine Throttle Control, Electric Starters, All-welded Frame, and Full Sectional Radiator. 110 and 210 cu. ft. machines are equipped with Duplex (2 Cylinder) Compressors; 280 and 330 cu. ft. sizes equipped with Triplex (3 Cylinder) Compressor.



M-W 280 cu. ft. RAILCAR
M-W Portables are available in Self-Propelled "Towabout" and Rail Car Mountings.



Remarkable Features of Design in M-W Portable Air Compressors

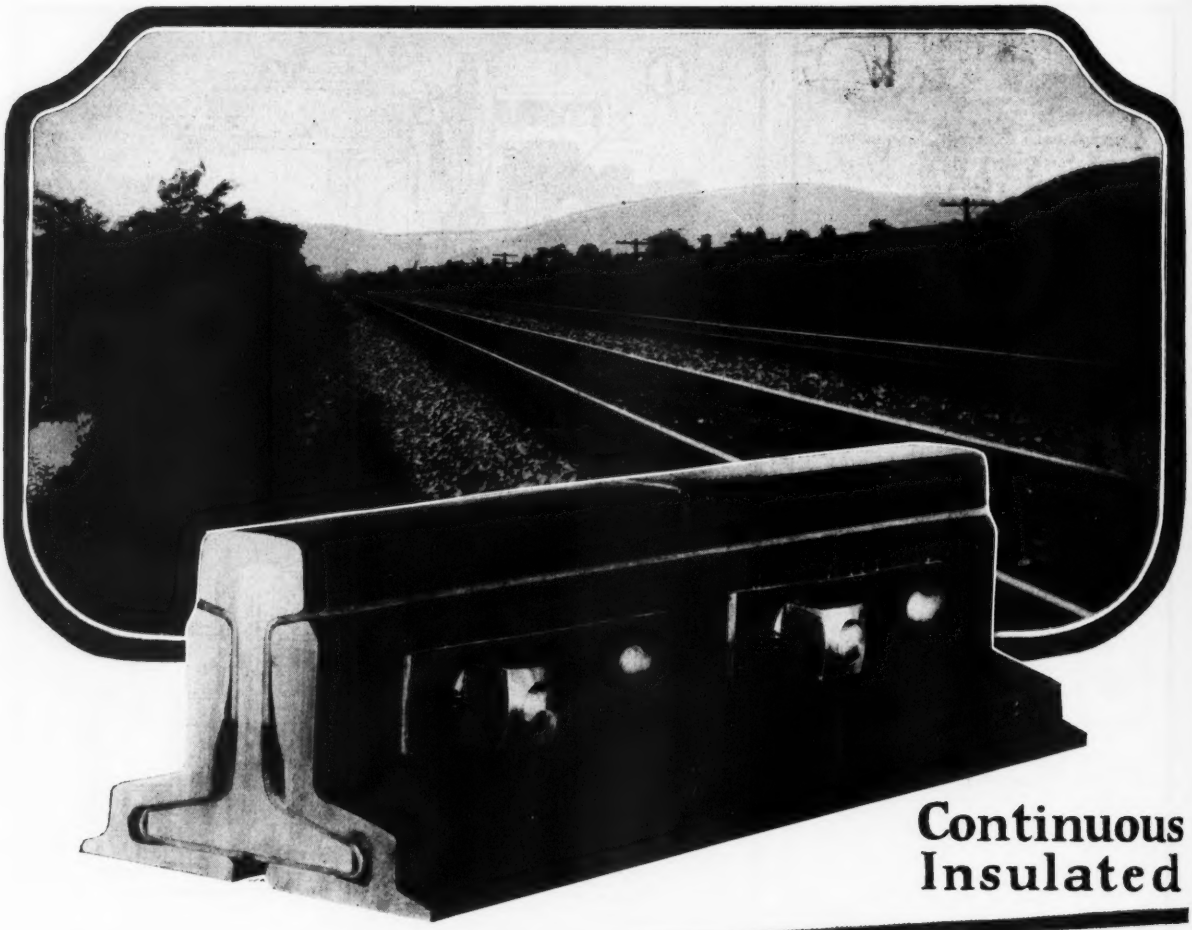
The important M-W features illustrated here represent a combination of advanced engineering principles found in no other type of Portable Air Compressors for Railroad use. The largest railroads, public utilities, road builders, and construction companies in the country use M-W Portables—every day, under all operating conditions, and at tremendous savings in labor and maintenance costs.

M-W Portables come in 110, 210, 280 and 330 cu. ft. sizes. They do the work of from 20 to 50 men. They are complete Air Power Plants on wheels—ideal for tie tamping, rail drilling, spike driving, rock drilling, paving breaking, etc. They will operate any standard type or make of pneumatic tools.

Read the valuable features listed here. Get full facts on engine features, Railcar construction details and arrange for free demonstration—without obilgation. Catalog on request.

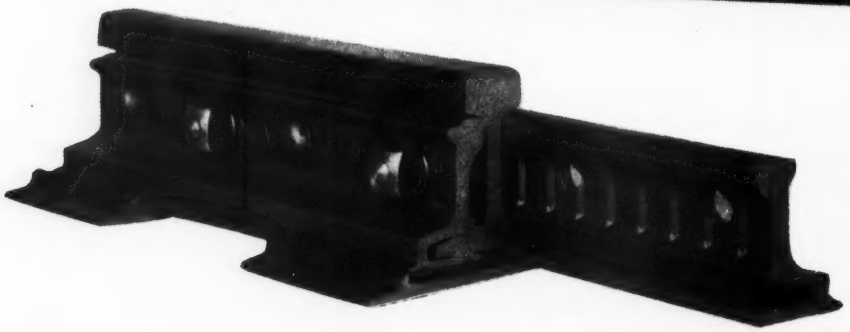
METALWELD, INC.
26th and Hunting Park Ave., Philadelphia, Pa.
(Dealers in all principal cities)

Metalweld-Worthington
Portable Air Compressors



Continuous
Insulated

KEEPING PACE WITH PROGRESS



Head Free
Continuous
Standard

RAIL JOINTS

THE RAIL JOINT COMPANY

165 Broadway, New York City

THE CLOSED-FACE RETAINING WALL
PERMANENCE—ECONOMY—BEAUTY

The marked trend toward this type of construction is evidenced by its growing use along the right of way of some of the country's most prominent lines.

Federal economy alone would be sufficient to give it preference over poured walls or three-piece crib construction. The strength and stability that result from its unique interlocking design are without equal in *any* type of crib wall.

In addition, Federal presents a *closed-face*—a feature welcomed by engineers for its clean-cut beauty. It keeps the back-fill from filtering through—it leaves no openings for vegetation.

The elimination of all maintenance expense—speedy erection in any weather—100% salvage when moved—each adds its measure of value to Federal excellence. Our data will interest you—send on request without obligation.

Note the Y-shaped headers which interlock with the stretchers and form a cellular wall of great strength. This construction holds the backfill without the use of a third member in the bank, to form a plane of cleavage.

FEDERAL CEMENT TILE COMPANY
608 South Dearborn Street, Chicago, Illinois

Concrete Products for 25 Years

FEDERAL CONCRETE CRIBBING

LAYNE
WATER WELL
SYSTEMS

Baltimore & Ohio Railway—Chicago Northwestern Railway—Chicago, Rock Island & Pacific Ry.—Chicago, St. Paul, Milwaukee & Omaha Railway—El Paso Southwestern Railway—Florida East Coast Railway—Illinois Central Railway—Louisville & Nashville Railway—Missouri Pacific Railway—Pennsylvania Railway—St. Louis & San Francisco Railway—Union Pacific Railway—Wabash Railway—St. Louis & Southwestern Railway.

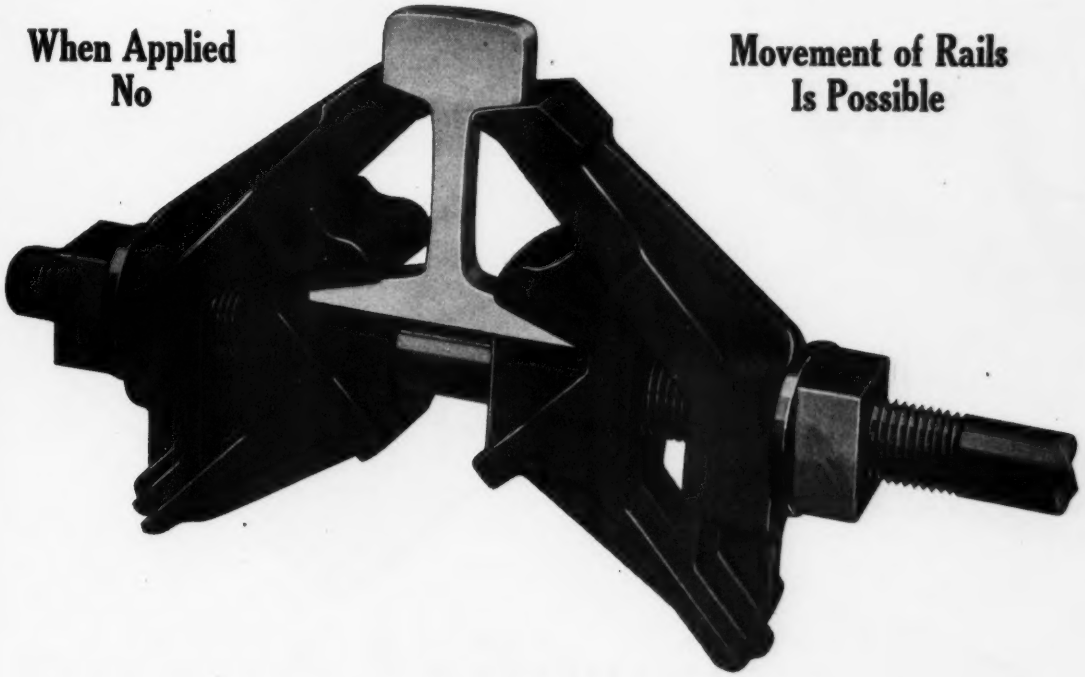
USED BY THE
NATION'S
RAILROADS

LAYNE BOWLER
MEMPHIS INC. TENNESSEE

ANOTHER COOVER— ATTAINMENT—

When Applied No

Movement of Rails Is Possible



This new Coover Brace not only grips the inside and outside flanges of each rail with a VISE GRIP—but also engages the under side of rail head, as in a vise.

UNIVERSAL—This brace as every Coover Product, is distinctly universal. The same clutches are automatically adjustable to different type and size rails. Therefore the same brace will fit all the different ARA and ASCE rails.

This brace is particularly designed to combat the extreme rail stresses encountered under certain conditions.

The VISE GRIP obtained not only on the base, but head of rail as well, eliminates every possibility of rails spreading, tilting or creeping.

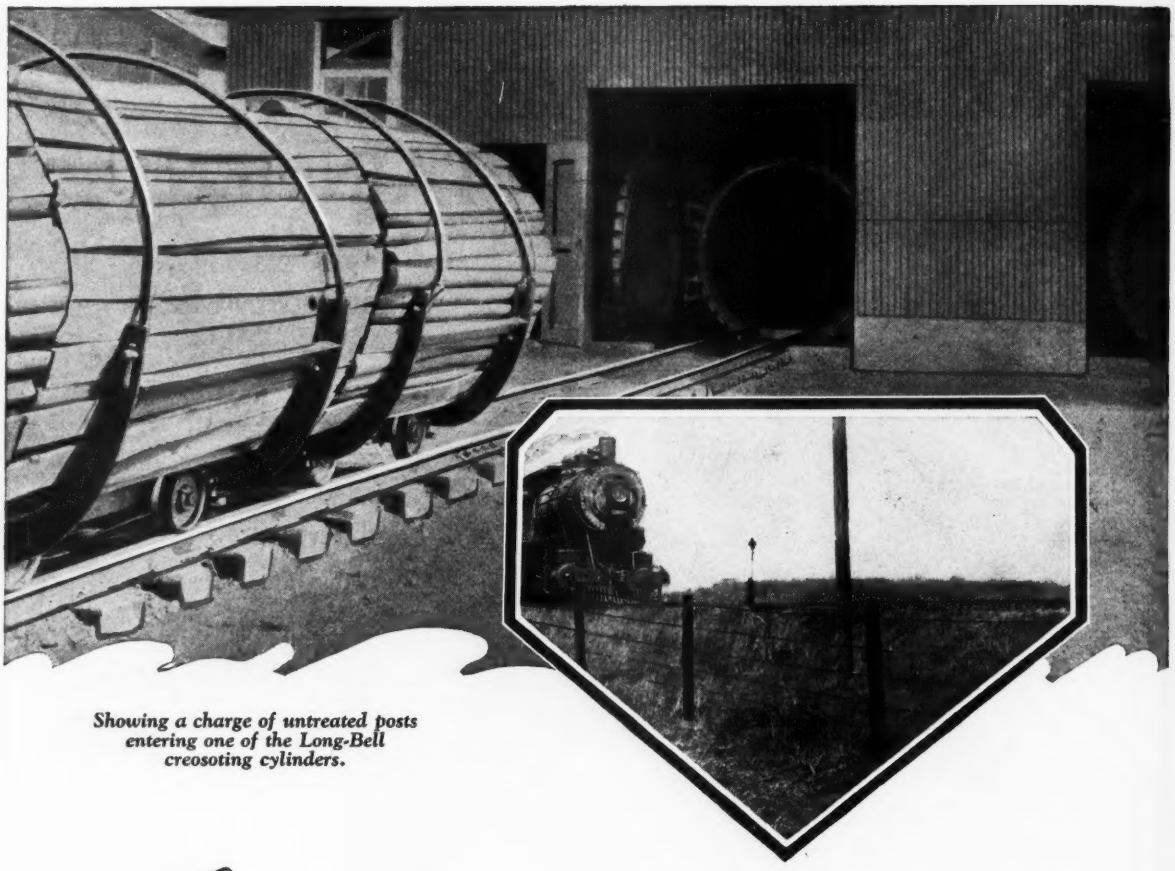
So secure are rails held that inner spikes are no longer raised nor outer spikes crowded —consequently cutting of ties by respiking—constant labor of regauging rail, retieing and respiking is eliminated.

This saving in material and labor, easily saves the cost of Coover Braces in a very short time—moreover, Coover Braces prevent loss of life, costly accidents, delays, track tie-ups, etc.

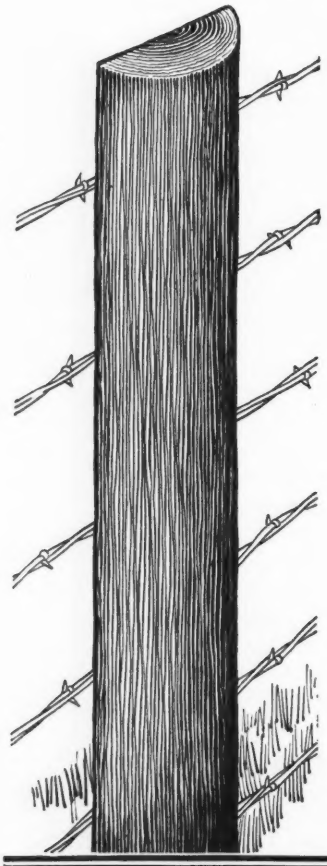
Coover has a brace for every requirement.

THE COOVER RAILROAD TRACK BRACE CO.

DAYTON, OHIO



Showing a charge of untreated posts entering one of the Long-Bell creosoting cylinders.



Fortified Against Decay *and* Fire

Long-Bell Creosoted Yellow Pine Fence Posts are thoroughly fortified against these two most destructive and costly elements of right-of-way fencing.

Pressure-treated full length with grade No. 1 Creosote they resist both decay and brisk grass fires. Practical tests over a period of years prove that they stand up where other posts would be weakened or destroyed.

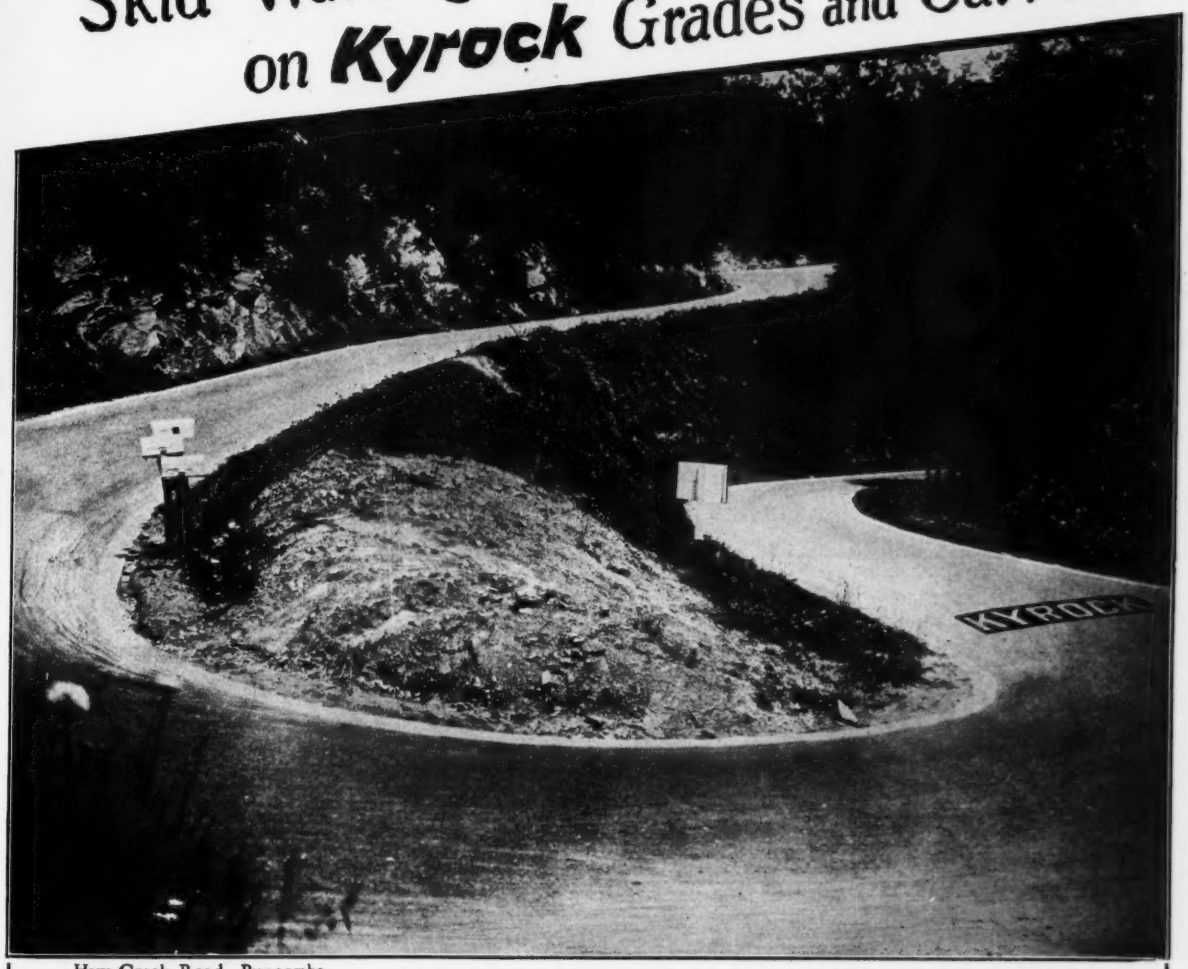
These strong, sturdy posts hold staples firmly, keeping the fence wire taut. And they give the right-of-way a neat, well-kept appearance.

Write for other facts on the advantages of Long-Bell Creosoted Yellow Pine Posts for economical, efficient right-of-way protection.

The Long-Bell Lumber Company
1718 R. A. Long Building, Kansas City, Missouri

LONG-BELL
CREOSOTED *Yellow Pine Fence Posts*

Skid Warning Signs Unnecessary on *Kyrock* Grades and Curves



Haw Creek Road, Buncombe County, N. C. Kyrock surface laid by County forces on macadam base. Road constructed 1925. Photo 1927.

KYROCK presents a sandpaper-like surface of fine silica sand that, wet or dry, affords ideal traction for rubber tires. A Kyrock road *does not become slippery when wet. Investigate Kyrock.*

KENTUCKY ROCK ASPHALT CO., *Incorporated* LOUISVILLE, KY.

Kyrock

The **Perfect Pavement**

KENTUCKY ROCK Kyrock ASPHALT

Michigan Central Railroad *equips over 300 doors with R-W-*

"The doors operate easily year after year. Our satisfaction is indicated by our constant re-orders"

J. F. Deimling, Chief Engineer, Michigan Central Railroad, says:

"In January, 1926, we completed a new 1190 ft. section of our freight house, making the total length 2000 ft.—perhaps the longest railroad freight house in the country. On one side of the freight house are the tracks; on the other side is a roadway where teams and trucks are constantly loading and unloading.

"In the original section of this freight house, which is 10 years old, we used Richards-Wilcox door hardware. Being perfectly satisfied with our 10 years' experience, we naturally selected R-W equipment for the newer additions. R-W equipped doors of the sliding type line the railroad track side of the freight house. On the teaming side, we use a vertical rolling door. All door openings are 9x9 ft.

"In June, 1926, we completed a new inbound freight house of the same type, three sets of tracks away. This building is 590 ft. long, with R-W equipped sliding doors throughout.

"Altogether, we have in these two freight houses over 300 doors equipped with R-W hardware, slides, and trolleys. We also have several FyReWall doors of Richards-Wilcox manufacture, as well as a folding door 17 ft. wide by 12 ft. high.

"At present we are constructing the Michigan Central Fruit Auction Building, which will be equipped throughout with R-W bi-fold and sliding doors and hardware.

"We have never had a complaint about our Richards-Wilcox equipment. The design is right, and the doors operate easily year after year. Our satisfaction is indicated by our constant re-orders."

R-W Engineers will gladly make an analysis of your plant requirements in the matter of doorways and conveying problems, without placing you under any obligation. Just write our nearest branch office.

Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides"

New York · · · **AURORA, ILLINOIS, U.S.A.** · · · Chicago

Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines
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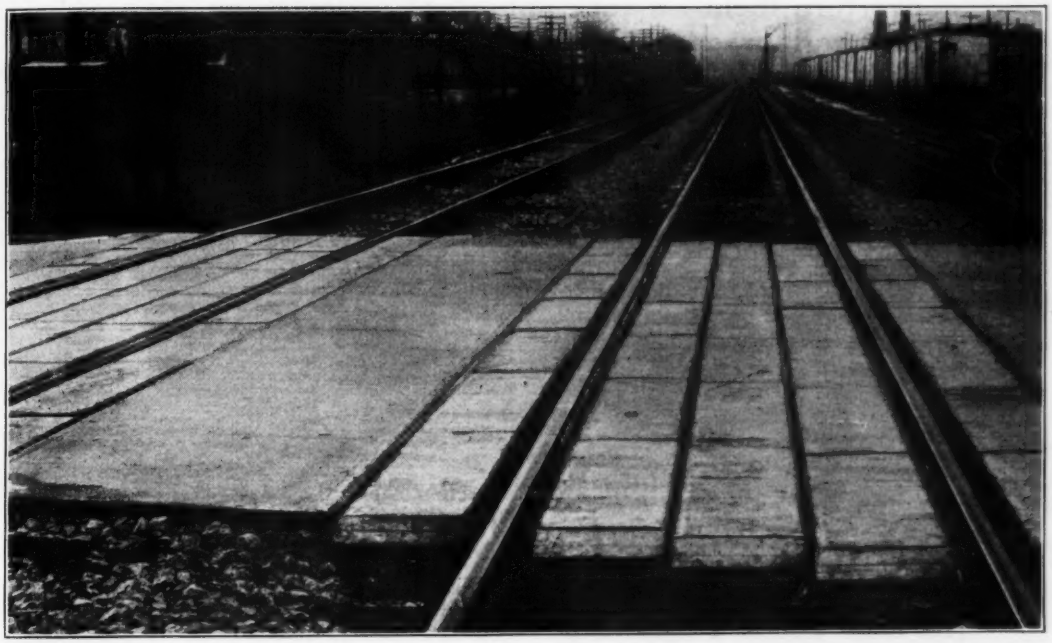
Montreal · RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. · Winnipeg

PERMANENT CONCRETE PRODUCTS

PERMACRETE



Concrete slabs for railway and highway crossings, mile posts, whistle posts, rail rests, fence posts—

Everything in pre-cast concrete products.

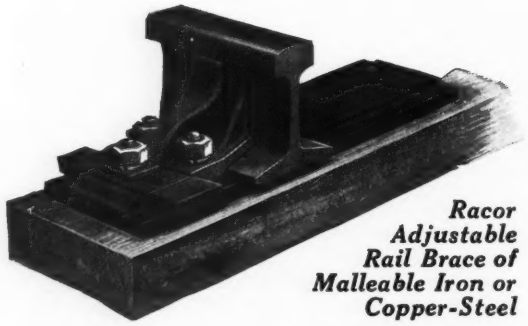
THE PRENDERGAST COMPANY

MARION OHIO

Sole Agents

Nothing but the best is good enough in a switch

Take rail braces for instance. They are essential on switches to buttress the stock rails against the side thrusts of traffic tending to widen the gage and overturn them—a very important undertaking. Is any rail brace good enough for this work? Or should it have strength, toughness, rust resistance and stand-up qualities—Racor qualities—to withstand the terrific strain on the stock rail?



Racor Adjustable Rail Brace of Malleable Iron or Copper-Steel

This brace assures a tight fit of switch point rail against stock rail, with an adjustment that will stay put, because it is possible to adjust the alignment of switch stock rail accurately at time of installation.

It can be furnished for installation to replace the heavy rigid braces used largely in interlocked switch layouts without moving the slide plates or without disturbance of the track.

Racor Drop Forged Rail Brace of Copper-Steel

These braces are of the plain type with a high rib for ordinary use or with a low rib to clear detector bars.

After being sheared to length they are ground to a close fit with the rail section or switch slide plate with which they are to be used.

The drop forged copper-steel of these braces is highly resistant to brine drippings and other corrosive influence.

RAMAPO AJAX CORPORATION

Main Office—HILLBURN, NEW YORK
SALES OFFICES AT WORKS, ALSO
30 CHURCH STREET, NEW YORK
McCORMICK BUILDING, CHICAGO

Eight Works—
Hillburn, N.Y. Niagara Falls, N.Y. Chicago, Illinois, East St. Louis, Ill.
Pueblo, Colorado, Superior, Wis. Los Angeles, Cal. Niagara Falls, Ont.

Railway
Engineering and Maintenance

Volume 24 May, 1928 Number 5

The Remote Contingency

THE railroads cannot afford to build their roadbeds and bridges to insure absolute security against damage by flood any more than they can construct buildings that will withstand tornadoes. This is owing to the differences between the discharge of streams following ordinary extremes of rainfall and the extraordinary run-off of drainage areas following an unusual combination of circumstances. This may take the form of a rain of unusual intensity for a short period of time on a drainage area with steep slopes, a less severe but steady fall of rain for a longer period, or a heavy rain accompanied by a rise of temperature on an area covered with snow. These circumstances or others having a like effect in different parts of the country occur in any one location only at rare intervals and it would be impossible for any individual, private corporation or public body to build railroads, highways or bridges which would be secure against unusual flood conditions which occur in any given location only at rare intervals.

Perhaps the most extreme illustration of unprecedented run-offs is the flood which occurred following the failure of the St. Francis dam in southern California. This was more severe than that which would have resulted from the instantaneous fall of twelve inches of rain over sixty square miles and it caused an enormous loss of life and property. Obviously no one would contend that the Southern Pacific line in the Santa Clara valley should have been built to withstand the effects of this unforeseen flow of water, but that would be but little more unreasonable than to expect the railroads to build all parts of their lines so that they will be secure against flood conditions of an extreme character.

String Lining of Curves

FEW articles that have been published in these columns have created as much interest as the series on the string lining of curves, the fourth of which appears in this issue. The number of letters that we have received, not a few of which have included requests for advance copies of the articles yet to be published, have demonstrated the demand that exists for a method of determining the correct alinement of curves without calling for an engineer with his transit.

The determination of the correct alinement of a curve is no easy problem. In spite of every effort to simplify the solution, there is a point beyond which it cannot be simplified. A curve follows certain mathematical laws and the solution of a problem involving its alinement of necessity involves a knowledge of these laws.

In the three articles on the string lining of curves that have already been published these principles have been stated. In the article in this issue and in the one that is to follow the application of these principles are demonstrated—a more involved operation. These two articles will not make easy reading. While presented as simply as possible, they still require the closest application if a thorough understanding of the method is to be gained. The advantages of string lining over instrument lining are sufficiently great, however, to warrant the effort. When the details of the computations have been thoroughly mastered the trackman will no longer be dependent on engineers' stakes but will be free to line his curves at his convenience whenever conditions require. This freedom will contribute materially to the continued maintenance of smooth riding curves. Furthermore, string lining is more flexible than instrument work for it permits a curve to be adjusted more readily to existing embankments and cuts than with a transit alinement, thereby making it possible to secure a smooth riding curve at the minimum expense for throwing and with the least disturbance of the roadbed.

Short Flagging

INSTRUCTIONS regarding the importance of flagging and proper methods of performing this important task are among the first received by the recruit in maintenance of way service. The necessity for a full understanding of the occasions when this protection is required is drilled into the employee from the time he enters the service. Yet, accidents continue to occur because of disregard of these instructions.

The necessity for the proper training of their men in respect to this duty should be kept constantly before the foremen by their supervisors. But it is particularly important at this season of the year that special emphasis be placed on this subject because of the number of new men that are being brought into the gangs by reason of the seasonal increase in forces. It is essential that the supervisor and foreman know that each of these men understands how to flag and when to flag. It is not enough to expect of them to know this—the supervisor and foreman must take the necessary measures to assure themselves that they do know it. Such knowledge can only be had by frequent checking of the individual workmen. On some divisions it is the practice of the foremen to discuss this subject with their men at stated intervals and for the supervisors themselves to check up the men while passing over their territories.

It is not enough that the men understand what is expected of them. It is equally important that they comply with instructions. The most common deficiency in this practice arises by reason of "short" flagging, whereby the man fails to go out a sufficient distance to afford adequate protection to trains. Not infrequently also a flagman stations himself where he cannot be seen for a sufficient distance by the crews of approaching trains.

While the record of the maintenance of way department as a whole is not bad in this regard, each spring sees a number of accidents resulting from improper flagging. Good as the record of the department now is, it is not sufficiently good to warrant relaxation in precautions so long as a single unnecessary accident occurs.

Tomorrow Might Be Too Late

THERE ARE many things that a section foreman should know and do instinctively if he is to conduct his work efficiently and safely. Other things must be taught and learned, and in many cases the simplest matters come under this latter classification. Usually one thinks of suggestions and instructions coming from the top down, and generally that is the rule which obtains and which should be expanded upon. Occasionally, however, the reverse is true.

A case in point is illustrated in a short penciled letter received recently from a foreman on a western road, who apparently does not know his English, but who has demonstrated that he has certain of the qualifications of a good foreman. This foreman asked that his note be "advertised" in *Railway Engineering and Maintenance*, and the thought contained was so pertinent that we quote from the letter as follows: "When moving on Motor car seeing things lay in track crossing Plank loose Track spreding let us not say we will do that in the Morning it might be to Late." In this sentence, roughly written as it is, there is an element of instruction for every one in the maintenance of way department, from supervisory officer down, and while the thought expressed is not new, it is one which will bear repeating.

Presumably, the writer was referring to the section foreman, to whom the instruction is particularly pertinent, for any one of a multitude of serious and costly mishaps could occur on the territory of a foreman who operates with the thought that "we will do that in the morning." It is not always a case of "might happen," for there are many cases on the written and unwritten records when something of a more or less serious nature has happened, and in the morning it was too late.

There is a lesson of large importance in the letter quoted, which may well be applied individually and passed on with some degree of force to those in subordinate positions. As it affects the foreman, it is the task of the supervisor or roadmaster, as a part of his job, to be constantly instructing his foremen in methods and practices for the safer and more efficient maintenance and operation of his road.

Are You Keeping Up to Date?

THERE WAS a time when the only requisite for success as a maintenance office was an ability to get things done. This requirement is just as important now as it ever was, but it is only one of several elements necessary for success. The officer today must not only get things done, but he must also exercise a fine discrimination in deciding how to do them.

There are two reasons for this. The first of these is the greater choice of methods, not only by reason of the introduction of the various mechanical appliances, but also because of the large amount of development work that has been done in the critical study of methods and materials. The second is the greater attention that is being given to cost; not the first cost, but the ultimate expense, taking into account the relative degree of permanence obtained by the several methods.

The maintenance of way officer is therefore confronted with the necessity of deciding such questions as whether cuts should be ditched or tiled, or both, whether weeds should be burned or poisoned, whether tracks should be ballasted before or after rail laying, whether concrete bridge slabs should be built in place or pre-cast, whether girder spans should be set by derricks or rolled in from the side. In fact, there is almost no task of importance that does not offer some choice of methods.

Unfortunately these many questions cannot be settled once for all by either the railway management or associations of railway officers, because the answers cannot be the same in all cases. This becomes apparent to the reader of the Questions and Answers department of this paper. Local conditions exert such a profound influence that the answer must be found in the light of the particular circumstances imposed in each case.

This, after all, is what makes maintenance work so interesting. It offers a challenge to the intelligence and understanding of the man in charge, it calls for a type of mind that profits by personal experience and is willing to learn from the experience of others. It is in affording a means for the exchange of such experiences and opinions that *Railway Engineering and Maintenance* finds its greatest influence.

Concrete in Sea Water

THE construction of the Florida East Coast extension to Key West was made possible by the presence of a ridge in the ocean bed, some of it below and some of it above the water surface. But this ridge is narrow and the railroad built along its backbone is exposed for its entire length to the sweep of ocean storms, and, with the well-known severity of tropical hurricanes, the idea of building a railroad in such an exposed location was a bold one. Not the least among the evidences of the courage of the builders was the construction of 17 miles of bridges supported on concrete piers built inside of cofferdams that had to be sealed by concrete poured under water, and the further fact that the larger part of these bridges comprised concrete arches. It must be remembered that the knowledge concerning concrete 20 years ago was far less complete than it is today and that reinforced concrete, which was employed in a part of the arches, was then in its infancy. Furthermore, the manufacture of Portland cement was not then attended by the high degree of standardization that prevails today.

In view of these considerations it is not surprising that some defects or evidences of deterioration have become apparent in the bridges of the Key West extension. But what is more significant is that these defects must be ascribed to shortcomings in certain incidental items of construction rather than to any inherent limitations of Portland cement concrete. Thus, defective conditions found at the bases of some of the piers must be ascribed to defective workmanship under conditions where perfect results are exceedingly hard to obtain, namely, in the pouring of concrete under water to seal the cofferdams. The other primary difficulty, that of the rusting of the reinforcing bars in some of the arches is clearly the result of placing the bars close to the exposed surface of the concrete, a practice which is definitely prohibited in modern specifications for sea-water concrete.

The correction of these defects, as described elsewhere in this issue, will entail the expenditure of considerable sums of money and it is to be expected, as

time goes on, that further expenditures will have to be made for work of a similar nature. But taken as a whole, the condition of the structures today is such as to justify the confidence which the builders of the Key West extension placed in concrete as a suitable material of construction. It must be remembered however, that these bridges are in tropical waters and that the concrete is not exposed to frost action. Any conclusions drawn from this example are therefore subject to this limitation.

When Should a Tool Be Retired?

ONE of the results of the safety campaigns waged on many roads in recent years has been the retirement of many tools that have become worn to such an extent that their further use involves increased danger of accident. This action does not go far enough, however, for many tools become uneconomical for service long before they become dangerous. The necessity for eliminating waste in expenditure has been held so prominently before railway men that the practice has become second nature with them of using every tool as long as it retains any service life. Yet this idea can be and is being carried to such a point that it is leading to excessive waste.

In those tasks in which the simpler tools, such as shovels for instance, are involved, the cost of the tools is small in comparison with the amounts expended for labor in their use. Maximum economy demands, therefore, that those tools be provided which will enable the men to do the most work. A road which insists that tools be used until they are worn out commonly pays for new tools several times over in decreased production without ever getting them. Thus, a laborer receiving $3 to $3.50 a day, equipped with a shovel 75 per cent efficient, will lose enough in output to pay for a new shovel every day or two and still have the old shovel.

The amount of loss by reason of the uneconomical use of these tools is so large as to warrant careful study by experienced maintenance men to determine the economical limit of use of each of the ordinary tools. Obviously, the degree of allowable wear is not the same for any two types of tools. Each must be studied individually and its economical limit of service determined. After this limit has been fixed, arrangements should be made to replace and retire tools whenever they reach this point, regardless of whether they appear to be fit for further service or not. Only by such practices can maintenance officers place their operations on the highest plane of efficiency.

Why Question the Facts?

WHEN SOME of our readers note the article appearing elsewhere in this issue relative to the unit cost system in effect on the C. & O., and in particular that part relative to the saving claimed as a result of the application of that system during 1927, we shall not be surprised if there are some who at first glance will think of the old saying that figures do not lie, but liars figure. Briefly, the cost department of the C. & O., in its review of the unit cost work during 1927, figures a definite net saving in the cost of conducting its mainteance work during the year of $298,305, after deducting $51,166 which represents the total cost of keeping the system in effect.

Why should anyone question the accuracy of such a report? In the first place, there are those who have always been skeptical of the value of cost analysis work. Then there are those who do not want to recognize the savings possible through such work because of the details involved, and again, there are those who have allowed themselves to become convinced of the fallacy of such work as the result of witnessing some half-hearted or incompleted cost analysis experiment.

The experiences of the C. & O. in the application of its unit cost system should upset these reasons. Three years ago this road was skeptical; it viewed the added details of unit cost analysis with some concern; and it was fully aware that a number of previous attempts to establish a unit cost system had been unsuccessful. Since that time skeptics on that road have become enthusiasts, details have become established routine, and previous failures have served only as a spur to greater success.

Since 1925, the C. & O. has definite record that the efficiency of its maintenance forces has increased 8.4 per cent, and that during 1926 and 1927 it has saved approximately $350,000 through the closer supervision and the elimination of uneconomical methods and practices brought about by reason of the unit cost system. There is little opportunity for anyone to alter the unit cost figures on the C. & O., for the system, as applied on that road, provides a check within itself at almost every step. Furthermore, the C. & O. is able to substantiate its figures relative to the increased efficiency of its forces and the savings which it is effecting under the unit cost system. This is through its material-applied records, which show that there was a substantial increase in the value of maintenance materials applied per man-hour of labor in 1927, as compared with both 1925 and 1926.

Everybody's Happy

FROM the manner in which the Delaware, Lackawanna & Western handles its track inspection and makes prize awards to its foremen, as described elsewhere in this issue, it is evident that the system employed is a paying proposition for all concerned, including the Lackawanna itself. Nineteen foremen were given the rank of "efficiency foremen" with a monthly increase in pay of $10, and 18 other foremen were given first and second prizes of $100 and $50 respectively in addition to silver medals. From this statement it is evident that the foremen benefit, as is intended.

In addition, however, the road itself also receives a return, for aside from the generally improved condition of its property as a result of its track inspection, the Lackawanna can point to definite savings of no small consequence in its maintenance expenses, which have been effected by the prize winning foremen. This is brought about through the first requisite of a prize section, that the labor expenses of the section shall not exceed a definite amount, that amount differing for each section according to conditions, and being determined on the basis of a definite allowance per equated mile of track.

Just how much the total saving was on the Lackawanna during 1927 due to the efforts of the foremen to stay within their assigned allowances, is not known, but from the bare facts in the case it is evident that there were 37 prize winning foremen who contributed toward this saving, and undoubtedly a considerable number of other foremen stayed well within their equated expense allowance, in their endeavor to be within the prize winning class. All of this has meant a considerable amount of additional thought and effort on the part of the foremen, and also on the part of those conducting the track inspection and making the awards. Apparently both were well rewarded, so everybody's happy.

What Our Readers Think

How to Determine Motor Car Loads

New York.

To the Editor:—

I have noted with interest an answer by C. R. Knowles to the question regarding the maximum loads that may safely be placed on motor cars, published in the April issue of *Railway Engineering and Maintenance*, page 175. In that answer I notice that Mr. Knowles fixes the several loadings at 2,000 lb. for 1¾ in. axles 1,200 lb. for 1½ in. axles and 650 lb. for 1¼ in. axles. He does not however, give the basis for arriving at these figures nor does he state whether the character of the material of which the axle is constructed has any bearing on its carrying capacity. This is an important question in connection with the operation of motor cars and I do not believe that the subject has been exhausted by the answers which appeared in the April issue.

I would like to suggest that this matter be referred to representative manufacturers of motor cars to learn their opinion on this important subject.

Motor Car Maintainer.

The Function of a Track Spike

Nashville, Tenn.

To the Editor:

I have given much consideration to the matter of the functions and proper methods of driving and maintaining track spikes, which were discussed on page 156 of your April issue. I have never attached much importance to measurements of force necessary to withdraw spikes from the tie for the reason that as the spike enters an untreated tie or one which has not been prebored the fibers are cut and torn, which permits the entry of water and the gradual relaxation of the "holding-down" power of the spikes. In the case of prebored holes, with the smallest bit practicable to use, about 7/16 in., the grip on the spike is not sufficient to overcome the lubrication afforded by the treatment and it is comparatively easy to withdraw.

A chisel-pointed spike and a diamond-pointed spike driven into new wood, in my opinion, from several tests made without any method of measurement, impose about the same resistance to withdrawal. The diamond point follows the hole absolutely while the chisel point departs from it to a greater or less extent.

The wave motion of the rail, as pointed out in the article, soon withdraws the spike from the depth to which it was driven, but during the early part of the driven life of the spike, if wave motion takes place the resistance to the withdrawal is such as to lift the tie. After this resistance is overcome, the tie remains bedded on the ballast while the rail swings above it, the amount to which the spike is withdrawn depending on the extent of the up-and-down motion of the rail flange.

With screw spikes, the period of resistance to withdrawal is much prolonged and consequently track laid with screw spikes requires much more careful maintenance to avoid churning of the ties. I believe it is the general practice of roads using screw spikes to leave a space of about one-eighth inch between the head of the spike and the top of the rail flange. The chief advantage which I see of leaving such a space with the driven spike is the tendency of spikers to drive the spike too hard and thereby injure the head and possibly the base of the rail. But it seems to me that in order to attain this condition absolutely it would be necessary to have a shoulder on the back of the spike to engage the tie plate or the surface of the wood in its downward course and stop the spike at a proper height. This, of course, implies that the tie be held absolutely against the base of the rail while the driving is in progress. If not so held, no such shoulder would be needed, as the base of the rail would stop the spike and when the pressure of the load is applied, the attainment of a perfect bearing on the tie will have the effect of leaving a space between the top of the rail base and the hook of the spike.

I consider that the chief function of a spike is to hold the track to gage. Certainly those on the outside of the rail are not called on to contribute anything toward resistance to its overturning. Those on the inside only function in this manner when the ties in which they are driven are sound. So long as the gage is held and sudden lateral pressures are not applied in an almost horizontal direction, the weight on top of the rail is what prevents it from turning over. The only end attained by constantly driving down spikes which have lifted by reason of wave motion of the rail is the polishing of the surfaces of the hole into which the spike is driven and each successive driving renders the spike more easily withdrawn.

The remedy for spike lifting is a thoroughly drained sub-base and ballast and thoroughly ballasted and amply tamped track. It has been my observation that on this kind of track, spike lifting is not apparent to an objectionable extent.

Summing up the situation, it is my view that the spike should be stopped in the driving at a point approximately one-eighth inch short of actual contact between the under side of the head and the top of the base of the rail.

Hunter McDonald,
Chief Engineer, Nashville, Chattanooga & St. Louis.

In the Early Days on the C. & O.

Savings Increase Under Unit Cost System

C. & O. Report for 1927 Shows Amplified Labor Output of $349,471 During Year

TIME is proving the effectiveness of the maintenance of way cost analysis work being done by the Chesapeake & Ohio, and is demonstrating that, in spite of adverse criticism and skepticism, this work is entirely feasible and can be made to effect large economies in executing the work of the maintenance department. The cost analysis system employed by the C. & O., which is known as the Unit Cost System, was described in detail in the November, 1927, issue of *Railway Engineering and Maintenance*. At that time it was stated that during 1926 there was an actual net saving of $51,240.92 in the labor expenses of the maintenance of way department of the C. & O., attributed directly to the judicious and efficient application of the unit cost system. The complete record of the operation of the system throughout 1927 has now been compiled and the outstanding fact presented is that a net saving of $298,305.42 in labor expenses was effected during that year, through the closer supervision of work obtained by the application of the unit cost system.

Operation of the System

Briefly, the unit cost system, as applied on the C. & O., is a method for making efficiency and cost analyses with the primary purpose of effecting immediate economies in the handling of maintenance work. The function of the cost department in directing the application of the system is primarily to assemble and publish essential data on the principal items of track work, promptly and in sufficient detail to permit those in charge of maintenance work on that road to see currently the results that are being obtained, and to enable them to plan future work in a manner that will insure improvement. The system is based primarily on the reports of the foremen, and upon the reports and observations of a group of trained engineers who assist the foremen, keep records, study existing conditions and make numerous time studies of actual operations.

The unit cost system was first established on the C. & O. in April, 1925, and was in effect over only one division. Gradually it was extended until by the first of 1927 it had been put into effect on 22 supervisors' districts, embracing a total of 1,624.50 miles of the 2,501.66 miles of roadway on the C. & O., and including all of the main lines and the more important branch lines. With 22 districts included under the system during 1927, the amount of work under observation during the year totaled 11,268,054 man hours, of which only 422,771 man hours, or 3.8 per cent, was not subject to rating as to its efficiency of performance. The total number of hours applied directly on track maintenance work was 10,286,237, this being paid at an average rate of $0.405 and giving a total payroll of $4,160,368.71.

From the detailed records kept, the general average efficiency of the maintenance of way forces for the year was found to be 83.4 per cent, as compared with 80.5 per cent in 1926, and 75.0 per cent in 1925. From these facts it is concluded that the improvement of 8.4 per cent in efficiency over the performance of 1925, resulted in increased output by the maintenance forces to the value of $349,470.98. One of the interesting features in connection with this saving, and one which is worthy of special note, is that detailed cost records indicate that

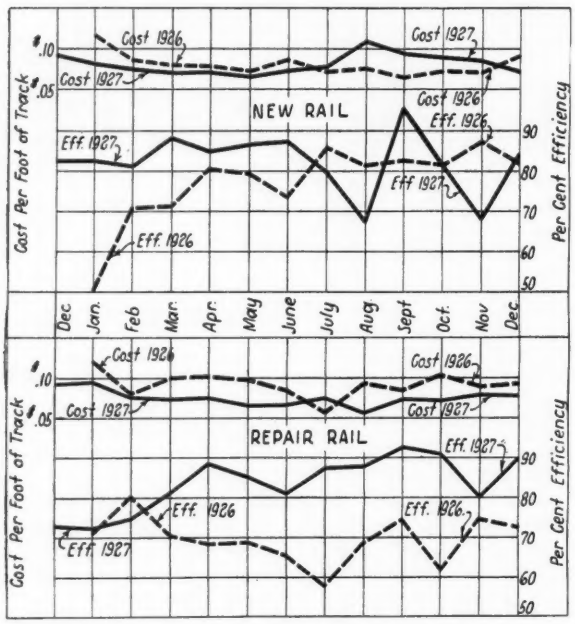
Monthly Expenditures and Improvement During 1927

1927 Month	M. of W. Hours	Average Hourly Rate	Payroll	Per Cent Improved Over 1925	Increased Output
January	698,421	$.413	$ 288,447.87	5.4	$ 15,576.18
February	667,206	.414	276,223.28	6.9	19,059.41
March	890,219	.401	356,977.82	9.2	32,841.96
April	923,227	.400	369,290.80	8.6	31,759.01
May	901,509	.405	365,111.15	7.9	28,843.78
June	1,003,885	.400	401,554.00	8.7	34,935.20
July	941,074	.400	376,429.60	8.4	31,620.09
August	882,759	.400	353,103.60	8.7	30,720.01
September	899,410	.408	366,959.28	9.1	33,393.29
October	996,893	.403	401,747.88	8.9	35,755.56
November	844,253	.405	341,922.46	8.8	30,089.18
December	637,381	.412	262,600.97	9.4	24,684.49
Year	10,286,237	$.405	$4,160,368.71	8.4	$349,470.98

the savings, or the reductions in cost effected, are not confined to specific items of work, but extend quite generally over all items. Similarly, they show that these reductions are effected quite uniformly throughout the various seasons of the year.

The table showing the distribution of expenditures during 1927, and the monthly improvement made in efficiency over that of 1925, clearly illustrates this latter point.

From the accompanying table it will be noted that the gross value of the increased output during the year amounted to $349,470.98, an amount which the cost department of the C. & O. is pleased to be able to substantiate by comparison with its "material applied" costs during the year, taken from sources entirely independent of the unit cost records. Through this comparison it is apparent that the unit cost estimate of saving is



System Cost and Efficiency Charts for 1926 and 1927 Covering Rail Renewals

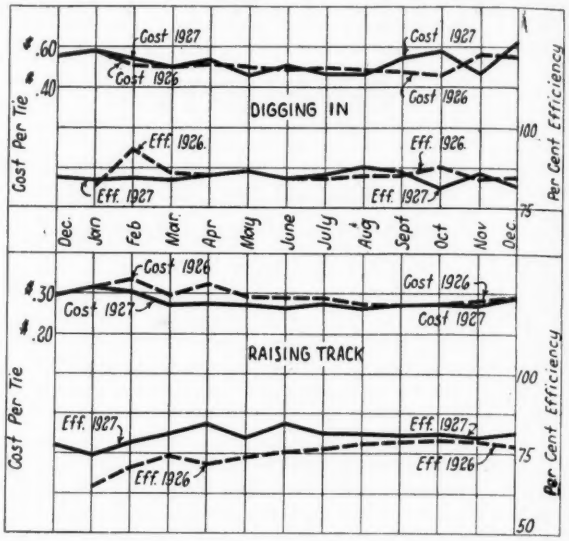
not only substantially correct, but decidedly conservative.

With the gross saving placed at $349,470.98, the net saving attributed to the unit cost system was $298,-305.42. This was arrived at by deducting the sum of $51,165.56 from the gross saving, which sum represents the total expense of operating the cost department, including salaries, traveling expenses, printing, etc.

Merits of Cost System Shown

With the continual functioning of the unit cost system on the C. & O., many of its possibilities and economies held forth by its exponents are becoming realities. Actual savings are being made, and each year the work of the department becomes more consistent and reliable, permitting the closer observation of maintenance operations and the prompt correction of defective or uneconomical methods. An additional advantage now being derived by the C. & O. through the reliable data which it has on hand, and through the greater experience of its cost department organization, is that of obtaining definite knowledge as to the desirabiliy of investing in various types of labor saving equipment and devices as they are advocated from time to time. Many such investigations and studies were carried out during 1927.

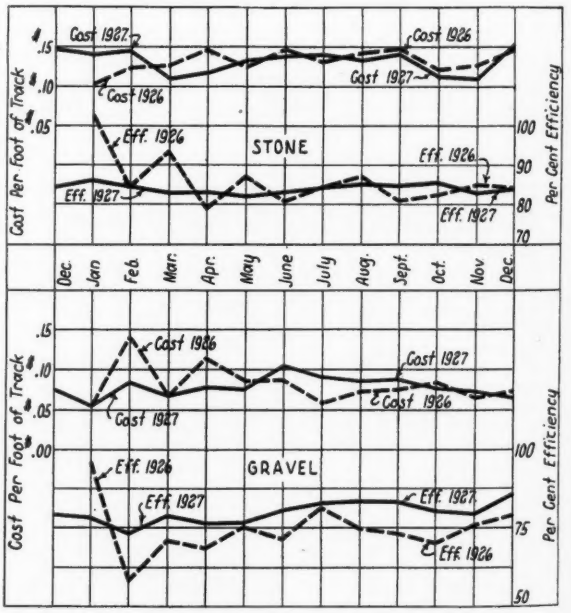
During the year, intensive studies were also inaugurated with the view of standardizing the methods of ballast application and rail renewals, and although these



System Cost and Efficiency Charts for 1926 and 1927 Covering Tie Renewals

studies have not been concluded to the point of adopting set routines, the corrections made in many local defects have brought about a marked improvement in performance.

Another instance during the year in which the cost department played an important part, was in the readjustment of section limits and the relocation of section headquarters. During the gradual development of the



System Cost and Efficiency Charts for 1926 and 1927 Covering Ballasting Operations

road, with the addition of trackage from year to year, section limits had become quite unbalanced in a number of instances, with attendant increases in the time of travel of section forces to and from working points.

The lost motion in this condition of affairs was soon observed by the cost department, and as a result, co-operating with the division officers, a complete survey of the tool house location situation was made, extending over the entire system. Wherever possible the tool houses were moved to the section centers, or section limits were adjusted so as to reduce the travel time of the section forces to a minimum.

That the cost department as planned would prove a most effective organization for building up a trained force of engineers equipped to serve in subsequent official capacities, has also been proved during the past year by the appointment of two of the assistant cost engineers to fill vacancies in the positions of assistant division engineers.

We are indebted for the information contained in this article to C. J. Geyer, engineer maintenance of way of the C. & O., and to C. H. R. Howe, cost engineer of that road, under whom the effective operation of the unit cost system has been carried out.

Laminated Roofs for Roundhouses

THE Southern Pacific has recently built two roundhouses of fireproof construction, one at Eugene, Ore., and the other at Klamath Falls, for which the roofs were constructed of laminated wood, the laminations consisting of select common Douglas fir, two-inch by four-inch dimension stock, set on edge and running lengthwise of the stalls, thus providing a roof deck four inches thick, on which was applied a heavy built-up asbestos roofing as a protective covering. The roofing is made up of a 60-lb. base sheet and a 14-lb. cap sheet, both impregnated with asphalt, and nailed to the roof deck with closely spaced galvanized roofing nails. These roundhouses, which are of similar design, have reinforced concrete frames and wall panels, with steel doors and sash and, aside from the plates and curbs for the engine pits, the roof is the only portion of the building where wood is used.

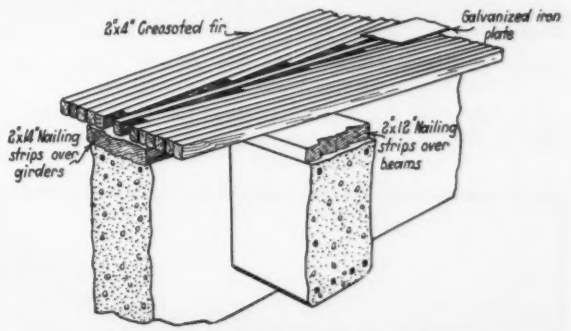
This type of construction was adopted for the roof because of the experience of the Southern Pacific with floors of similar type, which had demonstrated such fire-resistant qualities as to class them as almost equal to concrete slabs in this respect. It is almost impossible to ignite such a roof from below since there are no openings for the lodgment of flames on the under side, while the top is protected by the heavy asbestos roofing. For these reasons, it was decided to use this construction instead of thin reinforced concrete slabs for the roof where the locomotive gases have an injurious effect on the reinforcing bars, which are necessarily so close to the surface as to be acted on readily. The problems of design and construction were approached in the same manner as for the laminated floors and few difficulties were encountered.

The frames of the roundhouses consist of longitudinal concrete girders carried on concrete posts along the intersections of the engine stalls, which are 115 ft. long, out to out of end posts, the spacing of the intermediate posts being 23 ft. center to center, while the distance from the outer side of the end posts to the center of the nearest intermediate post is also 23 ft. Concrete cross-beams connect the girders over each post and also at the centers between the posts, thus providing spans of 11 ft. 6 in. for the roofing over the stalls. Two-inch planks, the same width as the girders and cross-beams, were grouted to the tops of these members to serve as nailing pieces for the members of the roof.

The 2-in. by 4-in. pieces making up the laminations range from 12 ft. to 24 ft. in length and run longitudinally with the stalls, arranged so that they break joints with adjacent pieces. They are laid parallel to the center line of each stall and are nailed together every 24 in. with 3½-in. nails, being also toe-nailed to the 2-in. nailing members on the concrete beams and girders. In placing them, all bowed pieces were straightened before nailing so as to provide a plane surface for the roof. The lower edges of the laminations were chamfered ¼ in., making a ceiling of pleasing appearance.

Arrangement Over Girders

In designing the roof one of the principal points to be worked out was the arrangement of the laminations on the longitudinal girders where, if the roof were entirely covered, long feathering cuts of the roofing material would be required. To obviate this it was decided to avoid all miter cutting and to allow the pieces to terminate with their square ends over the girders. This left an open space over the girders which was not only not objectionable but was actually of benefit in taking care of expansion in the roof deck, which is considerable in a structure of this size. As the roof covering was of built-up asbestos, these openings over the girders were bridged with strips of galvanized iron 10 in. wide, nailed to a 2-in. by 4-in. nailing member placed full length along the center line of the planks covering the girders. These planks, grouted full width to the girders, prevent the access of flames or gases to the expansion spaces and



Perspective Sketch Showing How the Roof Construction Is Handled Over the Girders

thus afford protection to the galvanized sheets and the roofing. In view of this protection it is expected that the galvanized iron will have about the same service life as the roofing.

Aside from the simplicity of construction the opportunity of nailing the roofing to the deck is considered an added advantage since the possibility of the roofing being torn off by high winds is practically eliminated. While these roofs have not been in use long enough to furnish data as to their probable life, officers of the road feel justified, in view of the many obviously desirable qualities, in installing more of the same design as the opportunity may present itself.

We are indebted to W. H. Kirkbride, engineer, maintenance of way and structure of the Southern Pacific (Pacific System), for data concerning this type of construction.

Southern Pacific Among Sufferers

Track at Oberg, the First Station East of Castaic, Was Thrown 200 Ft.

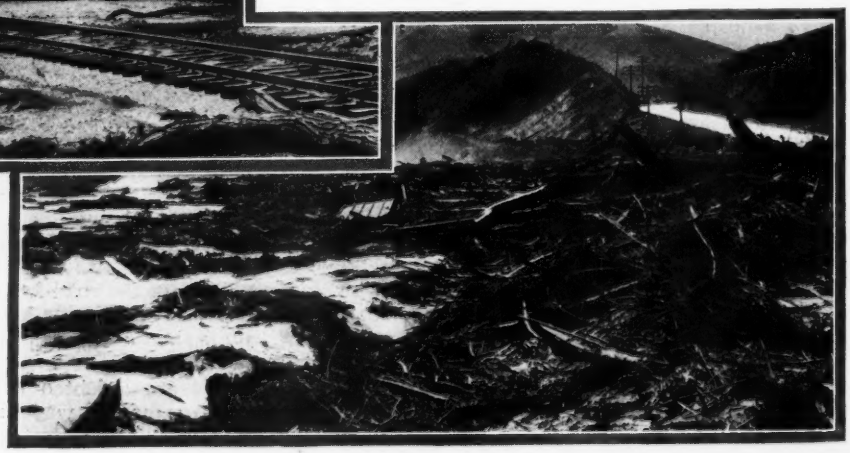
At the Top—One of the Freaks of Flood Action—Automobiles, a Flat Car, a Gondola and Other Debris in a Compact Mass

THE Southern Pacific and its employees were among the sufferers in the disaster which resulted from the failure of the St. Francis dam in Los Angeles county, Cal., in the early morning of March 13. Among the 400 persons reported killed or missing as a consequence of the rush of eleven billion gallons of water from the great reservoir, were 18 men, women and children at the section headquarters of one of the railroad's stations, while the loss to the railroad in property damaged or destroyed totaled between $250,000 and $275,000.

The line of the Southern Pacific which was affected by the disaster is a branch line extending east up the valley of the Santa Clara river from Montalvo, where it connects with the railroad's coast line, to Saugus, where the San Joaquin valley line of the Southern Pacific, extending down the canyon of the Santa Clara river from the east, turns sharply to the south to cross the San Fernando mountains in its approach to the city of Los Angeles.

About two miles east of Saugus on the north side of the Santa Clara valley is the mouth of the San Francisquito canyon, and it is at a point about nine miles up this canyon that the St. Francis dam had been built to provide an impounding and storage reservoir forming a part of the water supply system of Los Angeles.

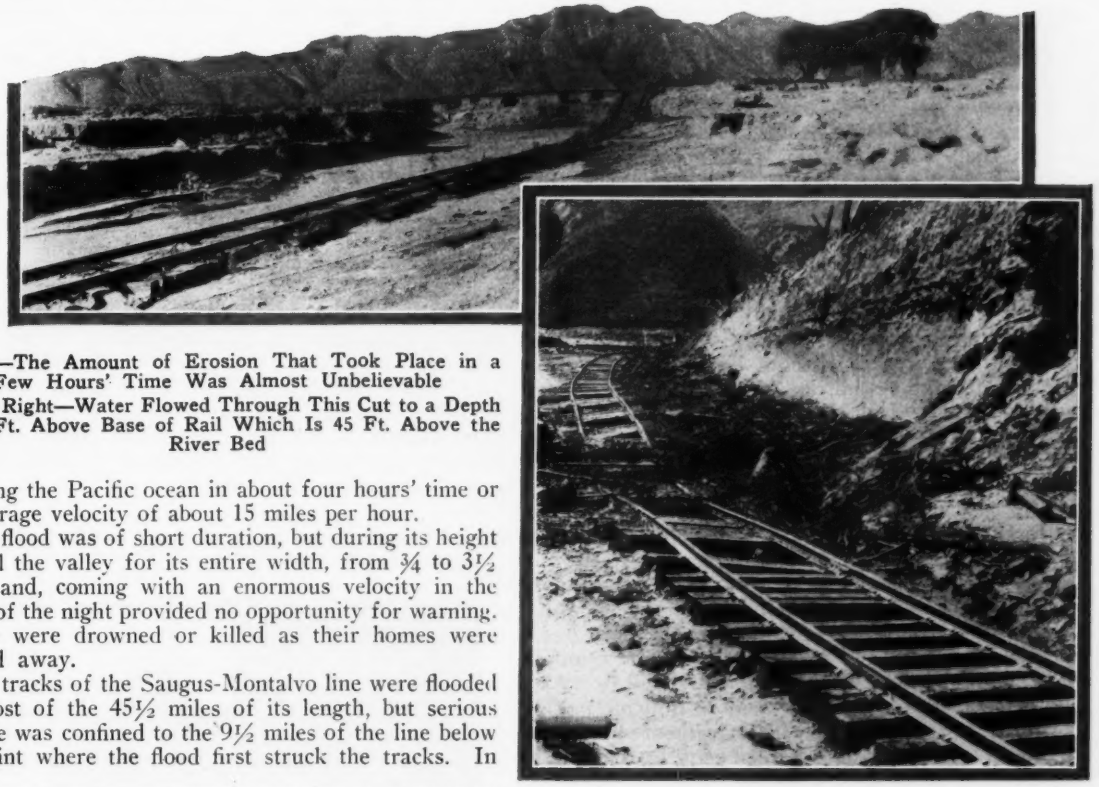
According to the report of an investigation committee of engineers and geologists, the failure of the dam was due to its construction on a foundation consisting in part of a conglomerate rock that disintegrates when soaked with water, and when the structure gave way the impounded waters rushed down the canyon and out into the valley of the Santa Clara. Turning to the west the rushing waters coursed down the larger valley,



Above—"Corkscrewed" Track West of Castaic Near the Site of the Section Headquarters

At the Right—Debris on the Roadbed for a Distance of 1,000 Ft.

From St. Francis Dam Disaster

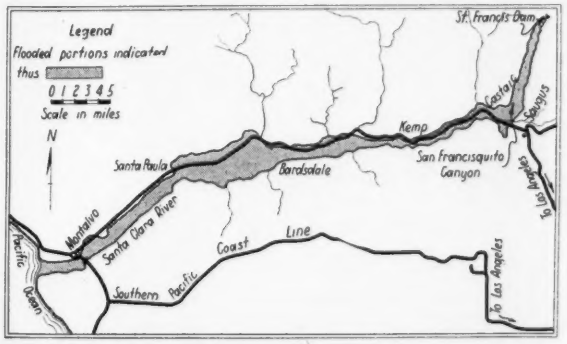


Above—The Amount of Erosion That Took Place in a Few Hours' Time Was Almost Unbelievable
At the Right—Water Flowed Through This Cut to a Depth of 17 Ft. Above Base of Rail Which Is 45 Ft. Above the River Bed

reaching the Pacific ocean in about four hours' time or an average velocity of about 15 miles per hour.

The flood was of short duration, but during its height it filled the valley for its entire width, from ¾ to 3½ miles, and, coming with an enormous velocity in the hours of the night provided no opportunity for warning. People were drowned or killed as their homes were washed away.

The tracks of the Saugus-Montalvo line were flooded for most of the 45½ miles of its length, but serious damage was confined to the 9½ miles of the line below the point where the flood first struck the tracks. In this district three miles of track were completely washed away and 1,150 ft. of trestle bridges and a 150-ft. steel truss bridge were destroyed. In addition, it destroyed section houses, corrals, station buildings, telegraph and telephone lines and fences. In fact, almost everything that stood in the way of the rushing waters was swept away.



Above—A Small Scale Location Map
Below—Driving a Temporary Trestle to Replace the 150-Ft. Truss Span Across the Santa Clara River, Three Miles Below Saugus. Wreck of the Span in the Foreground

At Montalvo, the Coast line of the Southern Pacific is carried across the Santa Clara river on a deck plate girder bridge, consisting of thirty-three 60-ft. spans, one 40-ft. span and one 50-ft. span, supported on concrete piers. When the flood water together with the large amount of drift and debris reached this bridge it banked up against it so that the water flowed over the top of the rails. But in spite of the enormous pressure which was imposed on the bridge, the structure remained secure and was not injured in any respect.

Illinois Central Cleans Well Screens With Acid

Adoption of This Method Obviated Removal of Strainer or Pump and Resulted in Large Savings

By C. R. KNOWLES

Superintendent Water Service, Illinois Central System, Chicago

THE Illinois Central recently cleaned the screen in an 18-in. well, 258 ft. deep, with commercial hydrochloric acid without removing the screen or pump from the well, at a fraction of the cost of renewing the well or screen. The method followed and the result accomplished are interesting in the fact that, as far as is known, this is the only case in railroad practice where acid has been used in cleaning the incrustation from screens of large wells without removing them from the well, although it has been used to some extent in cleaning pipe lines.

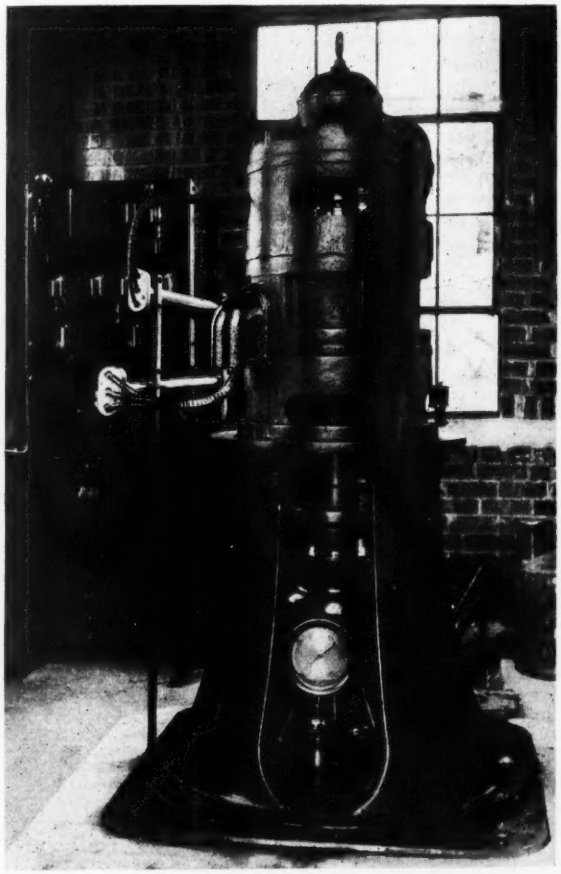
One of the principal causes of the diminished yield of water in wells is the incrustation or clogging of the screen. If the openings in the screen are closed by loose material, it usually can be removed and the yield restored by flushing the well or by applying back pressure. It is a more difficult matter, however, if the screen is closed by cemented material, as in a case of this kind it is necessary to remove the strainer for cleaning or to break up the incrustation by "bombarding" the screen with explosives or special tools. This latter process frequently injures the screen, while the results are not always uniform for the reason that it is impossible to determine how much of the incrustation has been removed. Thus certain portions of the screen may be cleared while other portions remain clogged, permitting the water to enter the well through only a portion of the screen, causing excessive wear of the screen at the point of entrance, with a resultant shorter life. It is, therefore, apparent that the successful cleaning of wells by acid will lengthen the life of wells and screens to a material extent, as well as provide a more uniform and adequate water supply where the production of the well is limited to somewhere near the actual requirements.

Well Was Drilled in 1919

The Illinois Central well which was cleaned with the acid is located at Pesotum, Ill., and was constructed in 1919. This well is cased with 18-in. casing to a depth of 180 ft. 3 in. The following 19 ft. 6 in. of the well consists of a shutter screen 18 in. in diameter, constructed of No. 8-gage iron with No. 6 openings. A blank reducing cone, 18 in. in diameter at the top and 13 in. at the bottom, connects the bottom of the 18-in. screen with a 13-in. screen 49 ft. 2 in. long, constructed of No. 8-gage iron with No. 6 openings. The ground water supply at this point is limited and it was necessary to provide all of the screen opening possible in order to secure the desired amount of water from the well.

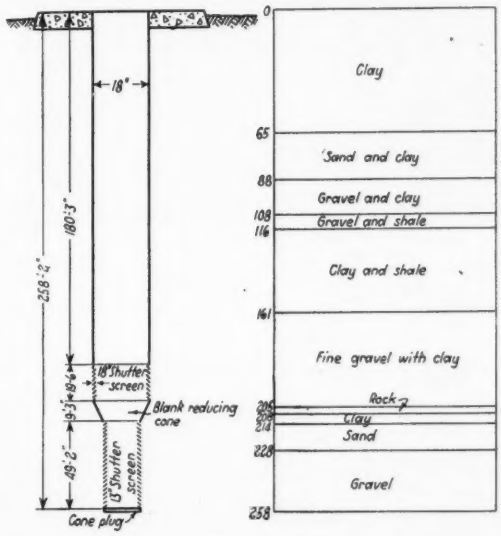
At the time the well was completed in 1919 it produced 160 gal. per min., but the production fell off to 42 gal. per min. in February, 1928, due to the incrustation on the screen. After giving the matter careful consideration it was decided to try to remove the deposit with acid instead of by mechanical means. Upon the recommendation of the manufacturers who installed the well and pump, 800 gal. of commercial hydrochloric acid was introduced into the well, which, when mixed with the water in the well casing and screen, formed a 30 to 40 per cent solution of acid.

The acid was received in 10-gal. carboys and introduced into the well through a 50-gal. wooden barrel and 1½-in. standard wrought iron pipe extending to a point in the well 200 ft. below the surface of the ground. A frame was constructed at the top of the barrel into which the carboys of acid could be placed in an inverted position, permitting the introduction



Pumps Like This Requires an Ample Supply of Water

of the acid uniformly and allowing the carboys to empty without being held in position by the workmen, as the gases and fumes from the acid would permit the workmen to handle the carboys for a short period only. The acid was allowed to stand in the well for 24 hour, after which the pump was started and operated continuously for the next 24 hours, the water being wasted into a ditch at the surface. Following the 24-hour period of pumping, the pump was



Log of the Well at Pesotum, Ill.

started and stopped repeatedly for 6-hour periods in order to flush the well thoroughly. The pump was then run continuously for an 18-hour period until the water cleared up, when the discharge line was reconnected to the tank and regular service resumed.

Cost of the Work

A test made 10 days after the treatment showed that the well was delivering 140 gal. per min., or more than three times the delivery prior to cleaning. The cost of the acid was 20 cents per gal. or $160 for the 800 gal. used, and the labor cost was $40. The pump, which is a multi-stage vertical turbine pump, was not removed from the well during the operation.

The analysis of the water from this well is as follows:

Dissolved Solids in Grains per Gallon

Iron, aluminum and silica oxides	0.30
Calcium carbonate	8.85
Magnesium carbonate	1.15
Sodium chloride	1.87
Sodium carbonate	13.94
Total,	26.11

It will be noted from the above analysis that the deposit on the screen consisted of carbonates; for this reason hydrochloric acid was used. Different forms of incrustation might require the selection of other acids. In other words, the acid best suited to dissolve the particular incrustation present should be used.

Particular care should be taken to prevent the acid from injuring surrounding wells or water supplies through underground communication, and the regular discharge and supply lines should be disconnected until sufficient water is wasted to avoid any possibility of the acid getting into the tank or supply system. Precautions should also be taken to dispose of the waste water in such a manner that livestock does not drink it, and that it is not emptied into streams where it might destroy fish or other forms of life.

Method Has Been Used by Others

While, as previously stated, this method of cleaning wells is new in railway practice, the process is not original, as it has been used successfully in other than railway installations. A 6-in. well, 60 ft. deep, with a bronze screen, was cleaned at Columbus, Ohio, by this method two years ago. At this point 400 gal. of hydrochloric acid was introduced in the well through a 2-in. pipe extending to the bottom of the well.

The acid was put in quite rapidly, the pipe through which it was applied being pulled back as the acid was introduced. The well actually became filled to the top with the undiluted acid, except for dilution with the small amount of water standing in the bot-

Removal of a Screen Is Expensive Work

tom of the well. The acid could not escape for the reason that the screen had become so incrusted that there was no outlet into the water-bearing formation. After the acid was in the well for a few hours it began to drop in the casing until a normal water level was reached. The well was restored to its original capacity by this treatment.

Another well at Lockland, Ohio, was treated successfully in the same manner. This well was 300 ft. deep and contained 60 ft. of 13 in. iron screen. A tank car of 8,000 gal. of hydrochloric acid was ordered to treat this well. The acid was carried to the bottom of the well through wrought iron pipes which were withdrawn as the acid was introduced. At the end of 48 hours the acid was pumped from the well and production restored.

Precaution should be taken, of course, to prevent

injury to the casing or screen by the undiluted acid or from too long an exposure. However, there is little likelihood of serious damage if ordinary precautions are taken, as laboratory tests of both iron and brass in a 40 per cent solution of hydrochloric acid show that it was not attacked to any great extent by the solution within a period of 24 to 48 hours. At the end of 48 hours the solution had a very faint yellowish color, showing that some material had been dissolved. There was a slow effervescence throughout this period.

Unique Methods Mark D. L. & W. Inspection

MOST ROADS have long since forgotten about their annual track inspection for 1927, but this is not the case on the Delaware, Lackawanna & Western for the prize winners on that road were not announced for some time after the first of this year. As a result of the inspection on this road, 9 foremen received first prizes of $100 each, 9 foremen were awarded second prizes of $50 each, and one foreman was given the rating of "efficiency foreman" for the first time, which is accompanied by a monthly increase in pay of $10 for a year. Eighteen other foremen, because of proficiency in their work, were allowed to retain their previous rating of efficiency foremen, together with the increase in pay accompanying that rating. In addition to the cash awards to the first and second prize winners, these foremen also received an engraved silver medal, and the first prize winners were awarded a first prize section sign to display on their sections. Efficiency foremen were given or allowed to retain efficiency emblems for display on their tool houses.

In carrying out the annual track inspection and awarding of prizes several practices are followed on the Lackawanna which are uncommon on other roads. In the first place, there is no system prize award, two prizes being given alike to foremen on each roadmaster's division. In the second place, there is created a group of what might be termed "super-foremen," who retain that rating with continued efficiency. In the third place, the actual physical inspection of the road is made by

First and Second Prize Medals for 1927

other than Lackawanna officers or employees, and lastly, no foreman is considered for a prize award if his labor expenses for the year exceed his allowance.

The inspection for 1927 was made last October by a committee of three specially qualified men picked by the Lackawanna from sources outside of its own road, presumably with the idea of obtaining strictly unbiased judgment on the condition of each foreman's territory. The committee making the inspection consisted of a public service officer, an industrial man, and a railroad officer. This committee travelled over all of the lines of the Lackawanna in an office car with observation facilities at the rear, one member rating surface, another line, and the third, the general condition of the right-of-way and station grounds.

With their report filed with the road, only the first half of the Lackawanna's inspection was completed, for, regardless of the winners as selected by the committee, no foreman was entitled to a prize unless his expenditures for the year were within his equated allowance. This latter condition is considered of large importance, since it is evident that just awards could not be made unless the expenses of maintaining the various sections of the road were taken into consideration.

In arriving at the allowable labor expenditures the various conditions existing on each section are analyzed carefully, and by applying a special formula, the work

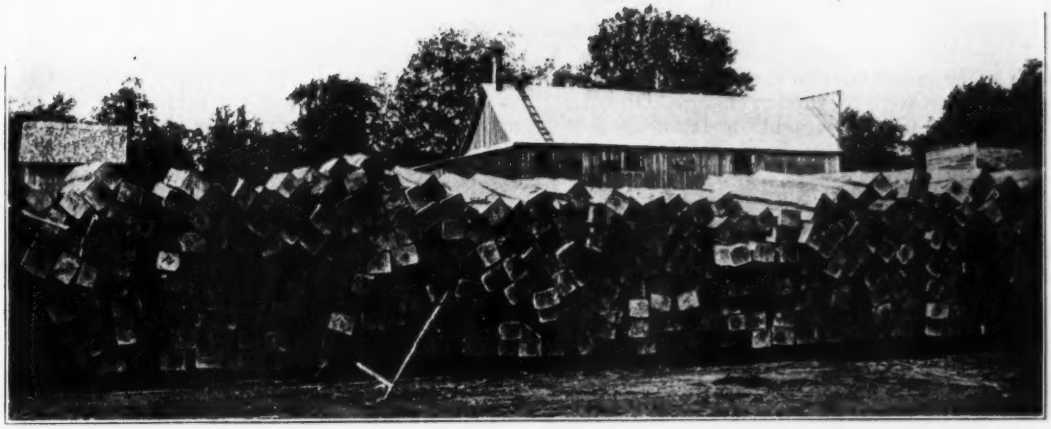
Division	Efficiency Foremen and Years Holding Rating		First Prize Winners and Ratings	
Morris & Essex East End	J. Venezia J. Worzel	3 1	P. Lamentino	92.67
Morris & Essex West End	P. Tozzi E. Morgan J. Morgan	12 10 4	L. Di Santis	94.0
Main Line Southern	W. Sutton	13	J. McDonald	93.17
Main Line Northern	A. Scott J. Fernan	3 6	J. Alfano	94.33
Buffalo East End	J. Greene T. Carey J. Romeo	15 10 5	J. Dodge	94.67
Buffalo West End	J. Keating J. Morgan	8 3	C. Velocci	95.17
Bloomsburg	D. Blizzard R. Shingler G. Thomas L. Miller	11 7 4 3	F. Pignono	87.83
Syracuse			P. Briganti	93.67
Utica	J. Morgan W. Locantro	5 5	J. Biviano	90.67

Efficiency Foremen and First Prize Winners on the Lackawanna

of each section is expressed in terms of equated miles of track. For each such mile, which is a common standard, a definite labor expenditure is allowed, and if a foreman does not exceed this equated allowance, he is entitled to consideration in the awarding of the prizes.

The efficiency rating award is given to all foremen who have won first prize for three years in succession, and having once achieved this rank, a foreman is entitled to retain it from year to year, together with the additional remuneration of $10 per month which it pays, as long as his territory is maintained in a first class condition and he does not exceed his equated expense allowance. During this period he does not compete for the division prizes, but if he should exceed his expense allowance, his rating of efficiency foreman is lost and he must again win a first place award for three consecutive years before his efficiency rating is again established.

The effectiveness of this rating among the foremen, and the conditions which surround it, is evidenced by the keen desire of the foremen to retain the rating, once they have gained it. This is clearly evident when it is known that the 19 efficiency foremen for 1927 have held this rating for an aggregate of 105 years, six of the foremen having held the rating for 10 or more consecutive years, and one for as many as 15 years. Of these same 19 efficiency foremen, only 2 have interrupted efficiency records, and in both of these cases the interruption was due to a change in their sections.



Tie Producers See No Shortage

Production Equal to Demand—Treatment and Decreasing Construction Reduce Requirements

IT WAS evident from the reports presented at the tenth annual convention of the National Association of Railroad Tie Producers, held at Hot Springs, Ark., on April 24-26, that there will be an adequate production of crossties this year to meet the requirements of the railways. This convention, which took place in the center of one of the largest tie producing areas in the country, was the most largely attended in the history of the organization, more than one hundred registering. The program was of special interest to railway men by reason of a paper on The Future Crosstie Demand prepared by Earl Stimson, chief engineer maintenance, Baltimore & Ohio, and by reports on conditions in the various crosstie producing areas, presented by the district directors of the association. All sessions were presided over by A. R. Fathman (vice-president, Western Tie and Timber Co.), president, assisted by Roy M. Edmonds, executive secretary, St. Louis, Mo.

The annual dinner, which was held on Wednesday evening, was addressed by J. M. Kurn, president of the St. Louis-San Francisco, who spoke on The Contact of Business, emphasizing the importance of the development of a closer tie between men in their business relations. A special feature of the convention and one that attracted a great deal of interest was a tie hacking contest in which three employees of the Western Tie and Timber Company participated, each of them being the winner in similar contests in his respective territories. Each man was given a 12-in. log sawed to length, and was graded on his speed as well as workmanship in hewing a tie.

New Officers Elected

At the closing session on Thursday morning, the following officers were elected for the ensuing year: President, Robert E. Lee, president, Hobart-Lee Tie Company, Springfield, Mo.; first vice-president, J. J. Schlafly, president, Potosi Tie & Lumber Co., St. Louis, Mo.; second vice-president, F. M. Fonville, vice-president, George W. Signor Tie Company, Shreveport, La.; and secretary-treasurer, Roy M. Edmonds, St. Louis, Mo. District directors: Pacific Coast district, J. Walter Kelly, Charles R. McCormick Lumber Co., San Francisco, Cal.; North Central district, W. J. Foye, Foye Lumber & Tie Co., Omaha, Neb.; North Eastern district, F. C. Parrett, Baker Wood Preserving Company, Washington Courthouse, Ohio; South Eastern district, C. D. Christian, Standard Tie & Lumber Co., Meridian, Miss.; South Central district, J. C. Fritschle, Hussey Lumber Products Company, St. Louis, Mo.

Statistics on Supply and Demand Are Presented

For several years there has been a feeling among the members of this organization that the collection and dissemination of information regarding the production, shipment and number of ties in stocks would do much to curb the violent fluctuations in prices that have long worked to the detriment of producers and railways alike. A Committee on Statistical Information was formed a year ago and E. E. Pershall (vice-president, T. J. Moss Tie Company), chairman, presented a report showing graphically the fluctuations during the past year, these curves being a composite of the records of a selected list of companies. These curves indicated that at the present time stocks of ties on hand are somewhat above normal, shipments are slightly below normal, production about normal and unfilled orders below normal. The discussion of this report indicated an appreciation of the need of anticipating periods of shortage and over-production and of the value of such data in protecting both buyer and seller.

In a paper on Forests and Floods, W. W. Ashe, secretary, National Forest Reservation Commission, Hot Springs, Ark., discussed the effect of forests on runoff, showing that under certain conditions forests will retard runoff and reduce flood heights. He laid greatest stress, however, on the capacity of the humus to retain moisture until the soil can take it and urged greater attention to fire prevention and to the curbing of the practice of burning ground over, for this destroys the humus and leads to more rapid runoff.

H. C. Baldwin, economic engineer, Babson's Statistical Organization, Wellesley Hills, Mass., spoke on the business outlook, forecasting a slight upward turn in industrial commodity prices followed by a somewhat lower trend later in the year and for some years to come, but with no sudden change. He anticipates no serious unemployment or labor troubles, although there will probably be some recessions in wages.

A paper prepared by Nelson Courtland Brown, professor in the New York State College of Forestry, Syracuse, N. Y., on the Failure of Substitute Crosstie Materials was presented on Thursday. This paper reviewed the number of patents that have been issued to date for ties of other than timber, and the failure of any of these designs to establish themselves was noted. "The wooden crosstie can go to a much higher price level," he said, "before the railways are warranted in giving serious consideration to substitutes. As time goes on, more and more ties will be cut from lands that have already been cut over for saw timber. Eventually all of our ties will be cut from forests that have been renewed naturally or through some system of intensive forest management. The future of the wooden tie, properly treated, is assured."

The Place of the Field Man

The place of the field man in a tie producer's organization was considered in two papers on Tuesday afternoon. Roscoe Hobbs, president of the Hobbs Tie and Timber Co., St. Louis, Mo., laid great emphasis on the necessity of an efficient field organization. "On it," he said, "rests the reputation of the tie company in the producing areas." After giving a number of rules for the guidance of field men in their relations with their time hackers, he referred to the necessity for the field men to enforce specifications, concluding with an admonition to field men that "if you don't buy rotten ties, they won't bring them in."

A second paper on the Problems of the Field Man was presented by Charles O. Paulsell of the Potosi Tie and Lumber Co., Potosi, Mo. After commenting on the difficulties confronting the field man in maintaining production of ties of better grade in poorer timber, he referred to the fact that hewn ties are produced by men working alone without supervision. He urged the tie producing companies collectively or individually to prepare a simple manual of instructions for the use of tie hackers, setting forth the requirements of the specifications and describing ways of producing ties of proper quality as well as pitfalls to be avoided. This suggestion was commented on favorably by some, while others contended that the fault for poor ties lay with the buyers, the hacker making ties no better than the yard man will accept.

Conditions in Producing Areas

The relation of production to demand, the adequacy of the labor supply and other conditions affecting the tie industry, were reported on for the various principal producing areas by district directors from those areas. In general, their reports indicated production equal to or in excess of demand with ample labor and generally satisfactory working conditions throughout the country.

Typical of these reports were those presented for the South Central and the North Eastern districts. For the South Central district (including Missouri, Arkansas, Louisiana and Texas), C. W. Billeiter, president of the George W. Signor Tie Company, Shreveport, La., reported that production has been in excess of demand, although many companies operating in this territory report operations only 50 to 75 per cent of normal. An adequate supply of labor is available, due in part to the increasing use of small mills. The dullness in the lumber market during the last year has also led a number of the larger mills to cut ties, adding materially to the production.

Conditions in the North Eastern district (that area north and east of Ohio and Virginia, including New England) were reported as normal by Harry Harmount, of the Harmount Tie and Lumber Co., Chillicothe, Ohio. Labor has been plentiful in this area during the last year, with production equal to that of 1926 during the first six months, falling off considerably during the latter half of the year because of lack of demand and increasing the stocks in the hands of the producers.

Tie Requirements Will Decline

By Earl Stimson
Chief Engineer Maintenance, Baltimore & Ohio

The railroads consume approximately 20 per cent of all of the lumber produced annually in the United States. Of this amount, 65 per cent, or about 2,725,000,000 F.B.M., is crossties. This is no inconsiderable quantity of timber to be provided for and the question of supply to meet this demand has caused some uneasiness. Naturally the adequacy of the supply depends upon the proportion of the demands.

Crossties are used both in the construction and in the maintenance of tracks, and the number required each year depends upon the mileage of new tracks to be built and the number of ties required for renewals. Another factor, but as yet a negligible one, affecting the demand for wooden crossties, is the substitution of ties made of other materials.

Peak of Railroad Construction Has Passed

The peak of railroad construction in this country was reached about thirty years ago. The necessity for new railroads and extensions no longer exists, although the work of internal development of the existing roads will go on as the increase in traffic demands. This means the construction of additional tracks, in multiple tracking, in reducing grades, revising alinement, building detour lines around areas of congestion, etc. Any increase that might accrue from the construction of additional lines is offset, to some extent, by tracks abandoned and taken up, as in the year ending 1926 a total of 3,140 miles of lines were reported as abandoned and taken up.

As stated before, the peak of railroad construction was attained about thirty years ago, or to be exact, in 1902, when 6,026 miles of new line were built. During the ten years ending 1907, which cover this period of construction activity, 48,829 miles of new lines were built, as compared with 5,954 miles built during the ten years ending 1927.

This indicates that the day of large railroad expansion has passed, that the increase in mileage has greatly slowed down, and that there is a tendency to still further retard the increase in total mileage, by the abandonment of lines and tracks that have outlived their usefulness, if they ever had any.

There are two factors that have recently entered into the problem and they may have a decided influ-

ence on the further extension of railroad facilities. They are:

First—The competition of the auto-vehicle using the highways. The privately owned automobile and the auto-bus have already taken over the greater part of the local passenger traffic and are making inroads on some classes of freight traffic. This competition is most severely felt on the branch lines and has led to the abandonment of much unprofitable service and may lead eventually even to the abandonment of the branch lines themselves.

Second—The consolidation of the railroads into the several large systems, under the Transportation Act, will make possible the unification of facilities of roads merged at common points which will make unnecessary some additional track construction in the future that otherwise might be necessary; there will also be the likelihood of the abandonment of duplicate facilities where not needed.

Little Prospect for Large Increase in Mileage

There seems, therefore, to be little prospect of any large or steady increase in track mileage in the future, and by the same sign there is seen prospect of a diminishing demand for crossties until the minimum annual renewal, as fixed by the life of treated ties, is reached. When this point is reached only such increase in the demand may be expected as will be due to the construction of new lines or the addition of tracks to existing facilities.

In 1926, of the total of 90,276,435 crossties used on the Class I steam railways of the United States, according to the Interstate Commerce Commission reports, 80,745,509 ties, or 89.4 per cent, were laid in previously constructed tracks in replacements and betterments, and 9,530,926 ties, or 10.6 per cent, were laid in additional tracks and in new lines and extensions. By far the larger number of ties therefore are used in the maintenance of tracks already built. The number of ties required for this purpose each year depends upon the length of life obtained from the ties in track.

This length of life depends upon the kind of wood, the physical characteristics of the track and roadbed, the density of traffic, the climatic conditions and, last and most important, whether the tie is treated or not. A gage of the importance of treating ties is the increased life it gives the tie. This increase is from an average of 8 years untreated to an average of 20 years or more properly treated. Treated ties have been used for years in increasing numbers until in 1926 the treated ties were 69 per cent of all ties used. In 1923 the per cent of treated ties in use was 50 per cent and if the rate of increase of the past three years continues, by 1932 practically all ties used will be treated ties.

Effect of Treatment on Renewals

The effect of the treated tie on the number of ties required for renewals is clearly indicated by the number of ties used and the total miles of all tracks on which the renewals were made, for which the figures for the years 1921 to 1926, inclusive, are available: In 1921, there were used 86,521,556 ties in 379,254 miles of track, or 228 ties per mile. In 1926, there were used 80,745,509 ties in 394,945 miles of track, or 204 ties per mile.

Thus, notwithstanding the fact that there was an increase of 15,691 miles of track during this period, 5,776,047 less ties were required for renewals in 1926 than in 1921. To what other agency can this be credited than that of the preservative treatment of the timber?

Now let us consider to what this is leading us. In 1926 there were used for renewals 80,745,509 ties, or 204 per mile of track, and in the same year there were used for the construction of additional tracks 9,530,926 ties, or about 2,600 ties per mile of track. The decrease in renewals since 1921 is 24 ties per mile of track, or at the rate of 4 ties per mile per year. The net increase in track mileage for the same period is 2,615 miles per year, and for purposes of computation we will assume a gross added mileage per year of 3,000, which will require a total of 7,800,000 ties to construct.

Assuming a 20-year life for treated ties, with all ties in track treated, the renewal will finally resolve itself into 130 ties per mile per year. Projecting by the straight line method, the present rate of decrease of renewals of 4 ties per mile per year, it will require 18½ years to reduce the 1926 renewal of 204 ties per mile per year to this figure of 130 ties per mile per year. This will be in the year 1944. When this state of renewals is reached the annual renewal requirements will be uniform and for the 1926 mileage of 394,945 will be 51,342,850 ties.

With this, however, must be considered the ties used in constructing new lines and extensions during this period which are assumed at 7,800,000 per year and which gives a total for the 18½ years of 144,300,000 ties, of which about 40,000,000 ties would have been renewed at the end of the 18½ years.

Treated Tie Holds Its Own Against Substitute Tie

The average renewal in this group at the end of the 18½ years would be approximately 4,000,000, which added to the 51,342,850 ties required for the 1926 mileage, gives a total of 55,342,850 ties for the 1944 renewal, plus the 7,800,000 for the construction of new lines and extensions, making a total of 62,142,850 ties to meet the demands in the year 1944, as compared with the demands of 1926 of 90,276,435 ties, which is a reduction of 31 per cent.

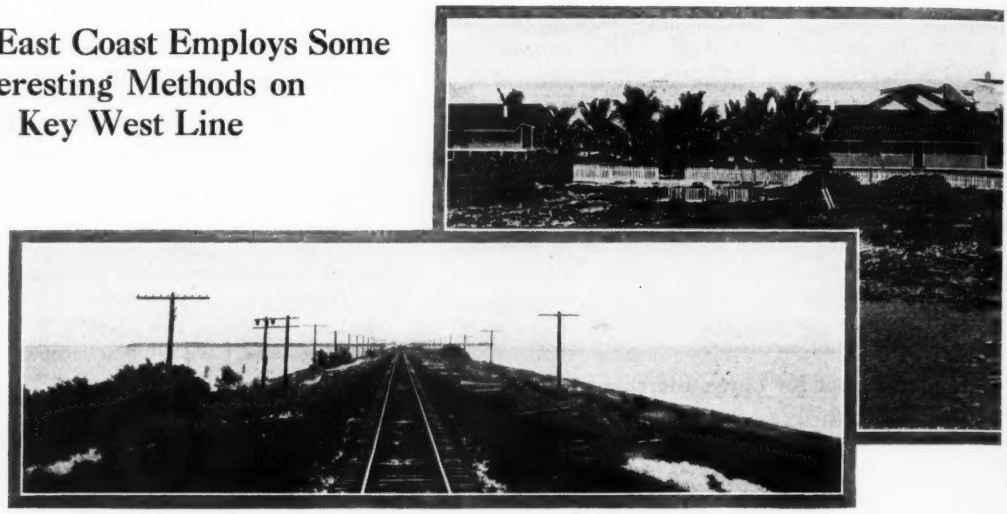
At this point we have secured the full benefit of the treated tie and we are at the average low level of crosstie requirements. Beyond this point the renewals per mile should remain stationary, but the total number of ties required for both renewals and for new tracks will increase as the track mileage increases.

And now as to the substitute tie, as it is called; despite the fact that for years inventive genius has spent itself in efforts to produce a tie as a substitute for and to displace the wooden tie, such efforts have so far met with but scant success. Substitute ties of almost every conceivable design and made of various materials and combinations of materials have been exploited and none have met the requirements of service or of economy. The treated hard wood crosstie, adequately protected by a properly designed tie plate, firmly secured to the tie, bids fair to hold its own against the substitute ties as long as you gentlemen are able to supply the demand for the wooden crosstie.

I have attempted to show that the demand for crossties will likely decline for a number of years to come and then gradually increase with any increase of track mileage, but perhaps never return to the magnitude of past demands. It is to be hoped, that with the proper conservation method, the supply of tie timber will be perpetuated and the tie producers will never fail to produce to meet the demand.

How an Ocean-Going

Florida East Coast Employs Some Interesting Methods on Key West Line



Roadbed Between the Matecumbe Keys. At the right—The Crossing of Pigeon Key

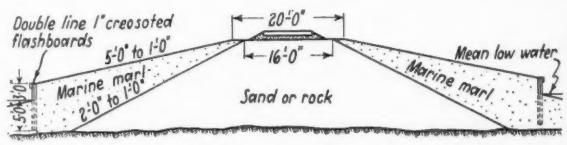
FEW railway projects ever undertaken in the United States make a stronger appeal to the imagination or possess more of the romantic than the construction of the Key West extension of the Florida East Coast, commenced in 1905 and completed in 1916. For a distance of some 128 miles from Homestead on the mainland this line follows the Florida keys, a backbone of coral rock projecting up from the ocean bottom in a great quarter circle that curves toward the Gulf of Mexico with Key West at its western end. Over 91 miles of this total distance, the railroad traverses the tip of the mainland of Florida and short stretches of roadbed cross the various keys which comprise those portions of the coral reef which are high enough to project above the surface of the water. For the remaining 37 miles, the railroad has been carried across the open water between the keys, 17.17 miles over bridges and 19.83 miles on embankments.

The line of the Florida East Coast was extended from Homestead to Key West to reach a point as near as possible to Havana, Cuba, and provide at its terminals in Key West the necessary facilities for the institution of car ferry service between the United States and Cuba through the utilization of ocean-going car ferries across the straits of Florida, a distance of 92 miles.

Built in the Face of Great Difficulties

Throughout its whole length this remarkable railroad is exposed to the sweep of tropical storms, a condition which added greatly to the difficulties of constructing a line in such an isolated location. These same conditions have been responsible for many problems of maintenance with respect to both the embankments and the bridges, and in meeting these it has been necessary to develop measures which are essentially unique. In order to appreciate the situation adequately it is necessary to present some facts concerning the physical characteristics of the line and a general idea of the manner in which it was constructed.

The whole construction program, including the construction of the Key West terminal dock facilities, was prosecuted under most adverse conditions, isolated from all sources of construction equipment and materials, accessories, labor, food and housing; even fresh water, which had to be brought to the job. The work was handled under the direction of J. C. Meredith, constructing engineer, until his death in 1909, and thereafter by his successor, W. J. Krome. The work involved the assembling, transporting, and distributing of 38,000,000 lb. of structural steel; 461,000 cu. yd. of concrete, requiring 800,000 bbl. of American and German cement, 96,000 tons of rock from Clinton Point on the Hudson river, 78,000 tons



Typical Section Through Protected Embankment

of gravel from Baltimore, Md., and Savannah, Ga., 300,000 cu. yd. of native coralline rock and 2,000 tons of reinforcing steel; 70,000 pine piles, 400 Jucaro piles; and backfilling material for concrete arch spandrels aggregating 77,927 cu. yd. of rock and 25,003 cu. yd. of sand. The terminal dock facilities at Key West, of ample capacity to provide adequately for handling and transferring cars to the sea-going ferries in the Havana service, also required extensive construction operations.

Thirty-five Miles of Pile Trestles

Temporary trestles constituted a large item of construction expense. These comprised construction trestles for handling trains of filling material from the flats or banks where it was obtained, as well as the filling trestles for making embankment and run-around trestles at the bridge sites. Several trestles constructed for use in forming embankment were later abandoned when it was decided to reduce the lengths of embankments and increase the width of

Railroad Is Maintained

clear openings at several waterways as a result of experiences gained in the hurricanes of 1909 and 1910. Several trestle docks at camp sites were also necessary for handling labor, materials and supplies, all of which aggregated a little more than 35 miles, or 187,234 lin. ft. of temporary structures requiring 78,000 piles. Steel erection was first contracted, but proved to be such a great risk that the extension construction forces completed this work with an organization developed for this purpose after the storm of 1909 had swept five girder spans from the piers and demolished the contractor's entire equipment.

Embankments Are Hard to Hold

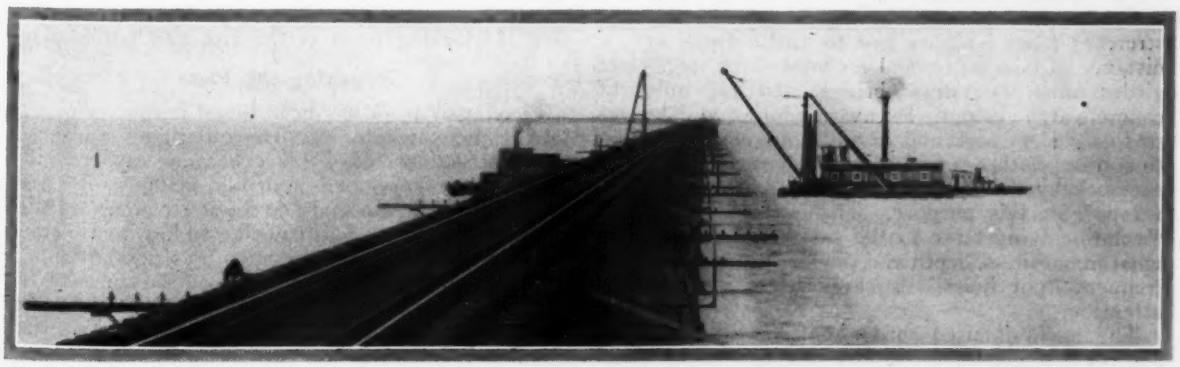
The grading operations comprised the protection of embankment and other necessary work in connection with the various phases of construction, and included the replacement of embankments washed out in the hurricanes of 1906, 1909 and 1910. They required the handling of 20,000,000 cu. yd. of material, including sand, rock and marine marl, which were placed largely by the use of dredges of various types, including suction, bucket and dipper, although considerable quantities were handled by work trains. Many difficulties were met in obtaining and handling the requisite quantities and experience in the hurricanes of 1909 and 1910 demonstrated conclusively that both the sand and the rock were impractical for rip rap, the latter being washed out quite as readily as sand. Inspection, however, showed that sections covered with marine marl successfully withstood the onslaught of waves and tides. This material was secured by dredging from banks or flats in nearby bays, loaded in air-dump cars, transported by work trains, and deposited from temporary filling trestles where it was allowed to assume its natural slope of about 5 to 1. Marl, when first placed, is soft and plastic, but eventually dries out and becomes nearly as hard as brick after which it does not readily absorb water and subsequent wetting renders the surface so slippery that backwash from waves and tides slides off with a minimum of damage. The results were highly satisfactory, as illustrated by the following quotations from a report of W. J. Krome, constructing engineer, dated September 17, 1919, on the hurricane of September 9 and 10 of that year:

"The West Indian hurricane which passed over the Florida keys on September 9 and 10 gave the Key West extension the first real storm test to which the construction work has been subject since its completion, and the results were satisfactory beyond our most optimistic expectations."

Provide Flash Boards

The only protection against the slow erosion of the marl slopes by ordinary waves and tides is the driving of flash boards, which have proved of material aid in the maintenance of the toes of slopes. This flash boarding is a wood fence consisting of a double row of boards driven at the water line and tied at the top with six-inch boards. At the beginning these were of untreated pine, but treated material was subsequently used when the effectiveness of the practice had been fully demonstrated. The design was varied to meet local conditions where the necessity for tie backs or other devices was apparent. Eleven miles of these flash boards were originally placed, followed later by 15.15 additional miles, aggregating 1,000,000 ft. b. m. of lumber. The storms of September and October, 1926, again illustrated the resisting qualities of the marl and the protection afforded by the flash boarding.

The marl embankments are doubtless ample to withstand one or perhaps several hurricanes; but with so much of the line directly exposed to storms driven over vast stretches of open water, there are manifestly constant and steadily increasing chances of injury, and neglect would eventually be disastrous. The repair work, therefore, constitutes a special



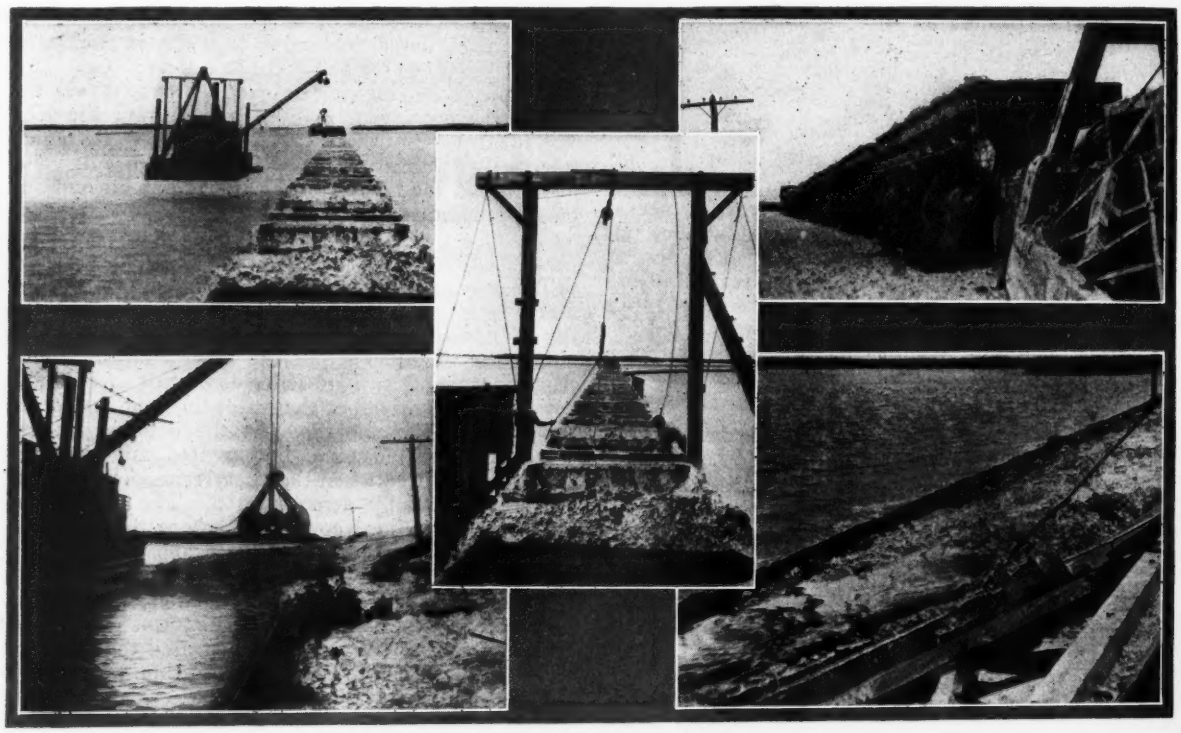
Pier Repair Plant at the Knights Key Bridge

maintenance problem involving constant replacements to combat the inevitable depreciation, and the inauguration of such practices as may be found necessary to correct defects that severe storms may develop, so that the embankments will be kept in a storm-resistant condition to insure the preservation of the full strength of the line as originally constructed. Marl has been used in the strengthening and repair work, and since the 1919 storm, 400,000 cu. yd. of this material has been handled by work trains in this service and by dredges operating adjacent to the foot of the slopes.

Extensive Bridge Work

The bridges on the Key West extension include six steel structures, four draw bridges, two transfer bridges for the car ferries, and 29 separate concrete viaducts. The water at the bridge sites varies from a few feet in depth to as much as 30 ft., the greatest depth being encountered at the Bahia Honda bridge. The longest continuous over-water structure stretches from Knights key to Little Duck key, a distance of 6.76 miles, and includes three steel plate girder units, one draw bridge, and 1¾ miles of concrete arch viaduct. Excavation for all foundations was carried to rock and in addition sufficient piling to support both dead and live load were driven into the rock by the employment of a special punch developed for this purpose. This rock is a coralline formation lying close to the surface, varying somewhat in hardness, depth and thickness, and exhibiting frequent "pot holes" or cavities requiring special attention.

The methods used throughout are illustrated in the construction of the Bahia Honda bridge, 5055.1 ft. in length, comprising 27 through truss spans and 9 plate girder spans. Sufficient piling was driven to support both dead and live load. Steel sheet piling was employed in the deepest water and wooden cofferdams elsewhere where possible. The wooden cofferdams were built in sections for convenient handling, lowered in place by derrick barges or catamarans, and secured to anchor piles. Centrifugal pumps were utilized for cleaning purposes and the concrete seal was placed by a tremie. After sufficient hardening of the seal the cofferdam was unwatered, the piling cut off below low water level, forms set for the lower portions of the pier shaft and the concrete poured to a level above high water mark, and water again allowed in the cofferdam. After the concrete had set sufficiently the cofferdam was again unwatered and the forms and cofferdams were removed. The remainder of the substructure for the steel bridges was completed by the usual methods. Arch centers for the viaducts were constructed in units and moved from pier to pier on barges. The setting and removing of forms was accomplished from the decks of the barges by jacking and by adjusting the size of blocking to meet the rise and fall of tides.



Typical Operations in Handling Marl for the Embankments

Upper right—Loading cars with a marine dredge. Upper left—Dumping cars. Center—Special hoist for closing doors of air-dump cars. Lower left—Replacing marl slope protection. Lower right—Using the spreader

Repairing the Piers

Pier repair work has been found necessary on certain sections where wooden cofferdams were used in construction. In 1912 it became apparent that fissures had developed in many instances between the concrete in the seals or footing courses and the underlying rock. Subsequent studies and inspections indicate that this condition was not attributable to erosion or to salt-water action on the concrete, but was caused by tide wash at the toes of the wooden cofferdams where sand bags used for protection were apparently ineffective.

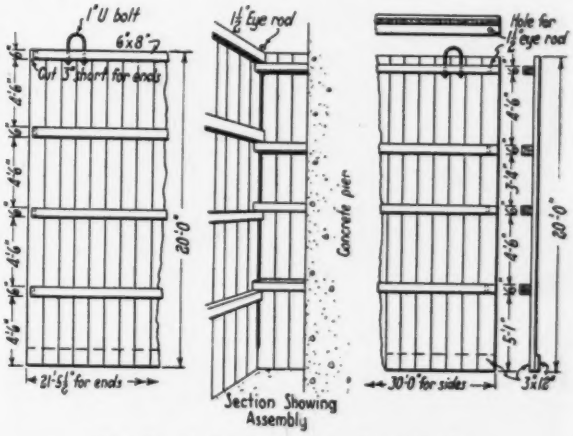
It was deemed necessary to re-seal some of the piers by surrounding their bases with a jacket about

two feet thick and four feet high, employing a small skilled organization adequate to plan, inspect and prosecute the work progressively. This outfit is supplied with floating equipment comprising a tug, pile driver, two derrick barges and barges for fuel, materials and supplies. The personnel includes a foreman, mate, diver, hoisting engineer, firemen, deck hands, laborers, a cook and a crew for the tug boat. These men live in camp cars to insure the greatest economical mobility. The piers are inspected by a diver who is an engineer, and all evidences of features requiring attention are charted and a program for the repair work is developed and authorized.

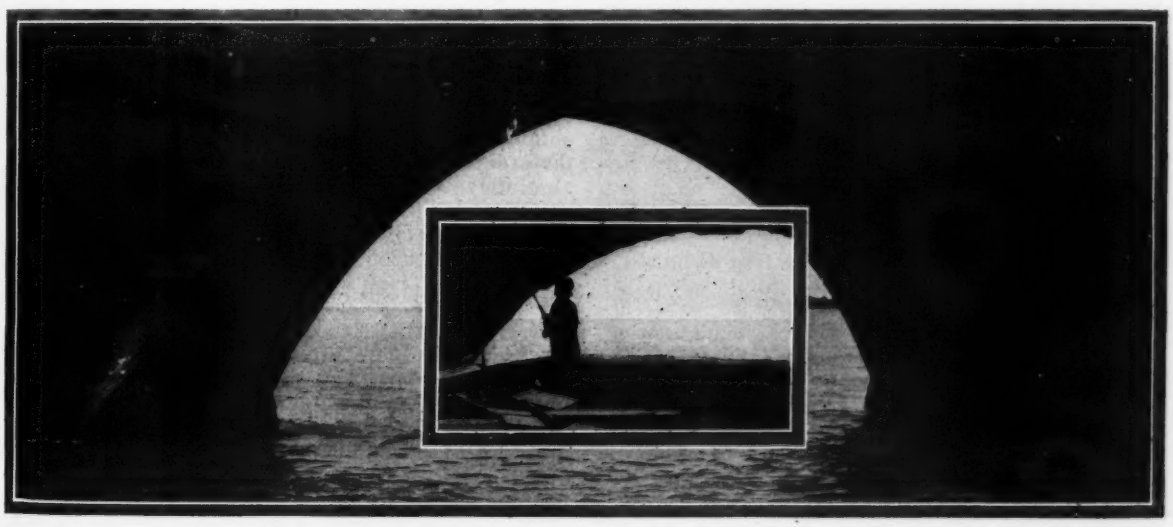
How the Work Is Done

In general the repair operations are made in the following order: The base of the pier is cleaned by the diver with the aid of a jet where only a small amount of over-burden is present and employing a centrifugal pump where greater quantities of material must be moved. Following this, a cofferdam is placed by the use of two derricks and outriggers from the bridge—this feature requiring care, especially in lowering the unwieldy transverse sections of the cofferdams under the span where there is limited headroom and hindrance by the tide. The cofferdam units, four in number, are fastened with heavy bolts and steamboat ratchets at the corners, which are rendered watertight with a strip of canvas secured by battens. Sand bags are then placed at the base after careful lagging of the bottom to eliminate inequalities in the rock surface. This work is done by the diver who also inspects the interior and removal of the cofferdam. Recent inspections of piers which have been repaired by the methods described above show a satisfactory condition.

The only reinforced structure on the extension was built at Long key. This consists of 10,446 ft. of reinforced concrete arches of 50-ft. span, later extended with 1,512 ft. of plain concrete arches of 35-ft. span. Rock from Clinton Point on the Hudson river, sand from Bear's cut in Biscayne bay, and a standard brand of American cement were used in its construction. The extrados of the reinforced arches on this structure have required attention, due to spalling caused by rusting of the reinforcing. Where these spots appear the method employed consists of the removal of the outside concrete with chipping hammers, after which the exposed steel is cleaned carefully with a sand blast and the original section replaced with gunite. Recent examination of this repair work, three to four years after completion, indicates that it has been effective.



Details of the Cofferdam Construction



One of the Viaduct Arches and Manner of Using the Cement Gun

cleans where necessary. A 10-in. tremie, 30 ft. in length, has been found most advantageous for depositing the concrete—the extra length affording sufficient pressure to insure effective discharge. The mixture used consists of three parts of native coralline rock passing a ¾-in. mesh screen and one part cement. The native rock contains sufficient fine aggregate to render the addition of sand unnecessary. Mixing is continued until a highly plastic consistency is obtained, the water content being especially important, as excessive wetness and dryness are equally unsatisfactory. When hardened the finished work receives final inspection by the diver after the re-

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CONSOLIDATION OF EASTERN RAILROADS.—It is reported that an agreement has been reached with L. F. Loree, whereby he will relinquish his plans for a fifth trunk line between New York and the West.

Determining the Throw for a Curve*†

The Explanation of the Steps Entering Into the Selection of the Ordinates for the Revision of Line

By CHARLES H. BARTLETT

IT IS a well known fact that a spiral or some other sort of easement curve is necessary to connect a circular curve with a tangent at each end. There are several reasons for this, chief of which is the fact that if the spiral was not there, there would be a considerable jolt as the train passed from the straight track to the curve.

Various forms of easement curves have been established and have enjoyed more or less extended usage. The two commonest forms of easement, however, are the Talbot spiral, and the cubic parabola. The mathematical properties of these two curves, insofar as they concern string lining, are so nearly the same that they may be considered identical for the purposes and scope of this discussion. As is the case with the circular curve, there is an analogy between the transit deflections, and the middle ordinates measured with a string. However, it is obvious that the ordinates at the several points of the spiral will not all be equal, but will vary according to some rule or law. It can be demonstrated that the ordinates vary according to the law:

1/6, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, etc., etc., where the ordinate at the point of spiral is 1/6.

Since for all practical purposes the first ordinates and the second also are usually quite small the first ordinate in the above series can be written as 0 without material error. Thus, in order to have a true spiral it is only necessary to vary the stringline ordinates in a series whose terms are multiples of the natural numbers in their proper order.

In previous articles we have considered the methods of making the computations required to line a given curve; that is, we have established rules for the mechanical operations which are absolutely the same for all curves, no matter what the degree of curve or how bad the alinement. The next question arising is therefore: How shall the revised ordinates be selected so that the best solution for a given curve is obtained? We have seen that, since the choice of the ordinates to be used for the revised curve is left absolutely to the discretion of the operator, there are several different solutions for any given curve. The problem is to pick the *best* one. This will depend largely upon what is meant by the term "best."

Depends on What Is Wanted

If that solution is desired which will make the maximum necessary throw a required amount (which is by far the commonest case in actual practice), one line of work will be followed. If it is desired to have a perfectly regular curve, or to eliminate certain branches of a compound curve in order to make a simple curve, it will generally be necessary to sacrifice small throws and use large throws to accomplish the result; accordingly, a different method of attack must be followed. If it is required to install a spiral in an existing unspiraled curve, the line of procedure is again changed. As still another example, if it is required to install a spiral which can be operated by trains at a certain fixed maximum speed (given by the railway timetable), the solution will be obtained in another manner.

It might be thought at first glance that the logical method to use in beginning to line a curve on paper would be to take the original ordinates as measured in the field, pick out a spiral to fit each end of the curve, subtract the sums of the ordinates used in these two spirals from the total of the original ordinates and divide the remainder by the number of ordinates remaining in the curve. For example, if

*This is the fourth of a series of six articles on the string lining of curves, describing the manner in which the line can be corrected by the track men without the use of instruments other than a piece of string and an ordinary rule. The first article of this series, which appeared in the January issue, Page 4, presented the merits of this practice in contrast with the use of a transit. The second article, which was published in the February issue, Page 62, describes the methods of taking the measurements. The third article, which appeared in the April issue, Page 168, presented the basic principles underlying this method of determining curve alinement. The fifth article, which will appear in the June issue, is a continuation of the article in this issue discussing the method of selecting the revised ordinates for a curve to give the minimum throw. The sixth and concluding article will describe the manner of placing the stakes preliminary to the actual lining of the curve.

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we assume a curve of 50 stations, the total of original ordinates for which is 978, we might pick a spiral for the beginning end (say, for purposes of this illustration, 0, 3, 6, 9, 12, 15, 18, 21) and a spiral for the leaving end (say, a spiral such as 0, 4, 8, 12, 16, 20). The sum of the ordinates in the first spiral is $3+6+9+12+15+18+21$ which equals 84; in the same way, the sum of the ordinates of the second spiral is 60. Thus, the sum of the ordinates for the two spirals is $84+60$ which equals 144. From our first principles, we have the theorem that the sum of the ordinates of the revised curve must equal the sum of the ordinates of the original curve. Hence, we have as the sum of all the ordinates of the revised *curve proper* (that portion between the two spirals), a total of $978-144=834$. But the first spiral occupies 8 stations; the second occupies 6; so that the two together occupy 14 stations. This leaves $50-14=36$ stations remaining for the circular curve itself. Thus, we see that the total of the 36 stations must be 834, which gives us an average ordinate of $834/36=23\ 6/36$. We could, then (other things being disregarded), obtain a correct total for the revised ordinates by using 30 ordinates of 23 and 6 ordinates of $24=690+144=834$.

May Require Excessive Throwing

The foregoing procedure, while (as pointed out above), appearing to a beginner as being more or less the logical thing to do, does not as a rule give a curve which can be obtained from the existing curve without excessive throwing of the original curve. The reasons for this can scarcely be understood unless the theory of string lining is studied.

Accordingly, we must seek another method. Actual practice in lining curves on paper has revealed that the best method consists in trying a certain spiral and a certain average ordinate for the circular curve, and in watching the throws as the lining progresses. That is, given a set of figures representing a curve, the operator will select a spiral, write it down and figure the throws it entails as he puts it down. Then he will progress to the circular curve, picking a trial ordinate and computing the required throws as he goes along. Of course, the selection of the proper spiral will be rather a hard task for a beginner, but it will be found that for each curve there is only a very limited number of spirals which can be used without entailing prohibitive throws. After having lined one or two curves, the operator will be able to see practically at a glance the spiral which best fits the curve.

Procedure to Be Followed

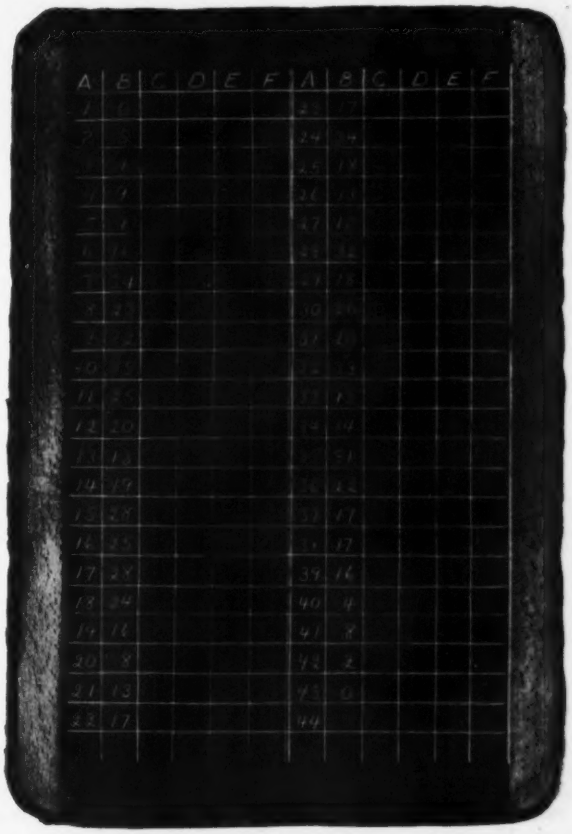
The reader should, by this time, be prepared to follow the steps in the solution of an actual numerical curve, inasmuch as he should now be familiar with the mechanical processes to be followed, once the revised ordinates have been selected. Since the commonest case met is that wherein the operator attempts to keep the throws below a certain arbitrary limit, we shall first take up this case.

In the curve in question, there are 43 stations. The chord length used was 66 ft. (length of two 33-ft. rails), and the ordinates were measured in tenths of an inch, and recorded as whole numbers, each unit number shown representing one-tenth of an inch. Thus, the ordinate 15 at station 10 represents an ordinate of an inch and a half.

Let us assume that the limiting throw has been fixed at 6 in. in both directions; that is, the actual curve may be thrown either 6 in. in (toward the center of the curve) or 6 in. out (away from the center of the curve). Since the figures we obtain are always exactly one-half the actual required throws, we shall have the condition that our half-throws cannot exceed + or — 3 in. Written as tenths of an inch, this means that our largest throws cannot be greater than + or — 30.

The Effect of Changing an Ordinate

An explanation of the actual effect of changing an ordinate should be explained here. Suppose we have a curve wherein the ordinate which seems to predominate in our solution of the revised curve is 42. If it appears, as we work along, that the throws are going to run up too high in a positive direction,



A Slate Will Be Found Convenient

[Note: One applying this method of lining curves will find it a great saving of time and labor to write down the original ordinates on a slate which has been ruled off into lines and columns. The work of making the changes necessary to the calculation of a curve is of such a character that erasures must necessarily be easy to make. The author has found that a slate, ruled into six vertical columns (one column each for A, B, C, D, E, and F) and with horizontal lines at intervals of about a quarter of an inch, makes an admirable board upon which to make the necessary changes and calculations. The lines should be cut into the slate with a knife or other sharp instrument, and station numbers should be scratched in with a pin.]

which means that the revised ordinate is too small, we can easily change the ordinate to 43. Either one or several ordinates can thus be changed. Frequently it is necessary to change only one or two of the ordinates to obtain the proper reduction in throw. This procedure, in effect, is equivalent to compounding the curve very lightly for a short distance, such as two or three rail lengths. For a 66-ft. chord,

changing the middle ordinate one-tenth of an inch changes the degree of curvature 5 min. and 15 sec. In the case above, if we changed three 42s to 43s, we would be compounding the curve from 3 deg., 40 min. and 30 sec. to 3 deg., 45 min. and 45 sec., for a length of 99 ft. Actually, on the track, no change of curvature would be apparent. Here, then, is one of the most valuable features of string-lining. By lightly compounding a curve for a short distance, we can cut down the throws required to line the curve, and yet not affect the riding qualities adversely. This could not be done with a transit except at great expense of time and labor.

With these points in mind, let us glance at the following curve.

On the slate the following notation has been used for brevity:

A is the station number of any station.
B is the original ordinate at each station.
C is the revised ordinate at each station.
D is the error or difference, B minus C at each station.
E is the sum of the errors, to and including each station.
F is the half-throw at each station.

Station Number (A)	Original Ordinate (B)	Station Number (A)	Original Ordinate (B)
1	0	23	17
2	5	24	34
3	7	25	18
4	9	26	13
5	9	27	10
6	16	28	32
7	34	29	18
8	23	30	20
9	12	31	20
10	15	32	33
11	25	33	13
12	20	34	14
13	13	35	31
14	19	36	22
15	28	37	17
16	25	38	17
17	28	39	16
18	24	40	4
19	16	41	8
20	8	42	2
21	13	43	0
22	17		

Selection of Initial Spiral

Let us, first of all, consider the spiral which best fits the entering end of the curve. The first step is to make a mental note of the point where the spiral appears to end, and of what the average ordinate for the entire curve seems to be. It is evident immediately that the spiral must start at Station 1, and must end either at Station 6 or Station 7. Inspection of the ordinates of the original curve shows that the average ordinate for the revised curve will have to be approximately 20, or close to 20, either one way or the other.

If we try a spiral with a factor of 4, we shall have as the revised ordinates, 0, 4, 8, 12, 16, 20. Let us try this and see what the consequent throws will be at the point where the spiral ends and the circular curve begins.

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
1	0	0	0	0	0
2	5	4	1	1	0
3	7	8	— 1	0	1
4	9	12	— 3	— 3	1
5	9	16	— 7	—10	— 2
6	16	20	— 4	—14	—12
					—26

The throw at the first station must be zero, on all curves, for the reason explained above. Accordingly, we write 0 at the first station, and proceed to compute the throw at the second station. At Station 2, the original ordinate is 5 and the revised ordinate is 4, which makes the difference, D, equal to +1. Since the error at the first station was 0, the sum of the errors to and including Station 1 is 0, and to and including Station 2 is 0+1=1. The throw at Station 2 is obtained by adding to the throw at Station 1 the sum of the errors in the opposite column. That is, 0+0=0, and this second zero is brought down in the throw column as the throw at Station 2. In this same way, the throw at Station 3 is obtained by adding to the 0 in the throw column at Station 2 the 1 in the sum of errors column at Station 2 and bringing the sum down in the throw column at Station 3.

Continuing in this fashion we arrive at a half-throw of —26 at Station 6. This means that the full throw at Station 6 is —5.2 in., which is nearly the limiting throw fixed at the outset. Consequently, we look at the next station to see what is going to happen there, and to see if the throw is going to run over our limit. The revised ordinate of 20 at Station 7 will give us an error at Station 7 of 34—20, or +14. This +14, added to the —14 which was the sum of the errors to and including Station 6, reduces the sum of errors to 0, thus making the throw at Station 8 the same as at Station 7. Accordingly, we shall try the revised ordinate of 20 for a few stations and see if it is suitable.

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
7	34	20	14	0	—26
8	23	20	3	3	—26
9	12	20	— 8	— 5	—23
10	15	20	— 5	—10	—28
					—38

It is evident, from the —38 at Station 11, that we have exceeded our limiting half-throw of 30. Now, we can change the half-throws and bring them within the assigned limits in several ways. For example, we have the choice either of changing the spiral in such a way as to reduce the negative throws, or we can change the ordinates of 20, making some or all of them, since so far there are only a few, 19. Let us try this latter method first. We have

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
7	34	19	15	1	—26
8	23	19	4	5	—25
9	12	19	— 7	— 2	—20
10	15	19	— 4	— 6	—22
					—28

We have, then, by changing the revised ordinate from 20 to 19, reduced the negative throws until they are less than the assigned limit. However, the last throw, at Station 11, is so close to —30 that we should examine the next one or two stations to see whether there is a possibility that the throws will exceed —30. We see that at the next station the original ordinate is 25, which gives as the error +6, thus making the sum of the errors at Station 11 equal to zero. Consequently, the throw at Station 12 will be —28+0=-28. Now examining the following station. We see that the error will be +1, thus making the sum of errors equal 1; the throw at Station 13 will then be —27. However, at Station 13, the original ordinate is only 13, making the error —6, which will make the sum of errors at Sta-

tion 13=–5, and the throw at Station 14=–32. The work is as follows:

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
11	25	19	6	0	—28
12	20	19	1	1	—28
13	13	19	— 6	— 5	—27
14	19	19	0	— 5	—32
					—37

Here, again, we have over run. Let us, therefore, try the method of reducing the spiral. Try a 0, 3, 6, 9, 12, 15, 18, (and, if necessary, 20 as an approximate final term) spiral. The work is as follows:

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
1	0	0	0	0	0
2	5	3	2	2	0
3	7	6	1	3	2
4	9	9	0	3	5
5	9	12	— 3	0	8
6	16	15	1	1	8
7	34	18	16	17	9
					26

It is immediately evident as soon as this point is reached that, with such a spiral, the throws will far exceed the assigned limit in the positive direction. Accordingly, we have now the information that a spiral of factor 4 is too large and a spiral of factor 3 is too small. It is obvious, therefore, that some spiral in between these two figures must be used to obtain good results. Any fractional multiplier can be used to obtain a spiral; but, since fractional ordinates are not used, we must add or drop the fractional part of the units in writing down the spiral. For example, a spiral of factor 2/3 would, theoretically, be as follows:

0, 2/3, 1 1/3, 2, 2 2/3, 3 1/3, 4, etc.

But, in order to have whole numbers, we may write this spiral in a number of different ways, choosing for our use that one which best fits the curve upon which we may be working at the time. Thus, we may write

0, 1, 1, 2, 3, 3, 4, etc.

If we choose a spiral of factor such as 4½ we may write either of the following:

(a) 0, 4, 9, 13, 18, 22, 27, 31, 36, etc.
(b) 0, 5, 9, 14, 18, 23, 27, 32, 36, etc.

In (a), the halves are dropped, and only the lower numbers used, while in (b) the halves are added to those figures in which they occur. Either of these may be called, with equal accuracy, a spiral of factor 4½—or, more simply, a 4½ spiral.

In the curve with which we are dealing, it was evident, from the above calculations, that the 4 spiral was better suited to the curve than the 3 spiral, since the sum of the errors did not increase as rapidly. Let us, therefore, try a 3½ spiral, adding the halves, as follows:

0, 4, 7, 11, 14, 18, etc.

We have the following:

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
1	0	0	0	0	0
2	5	4	1	1	0
3	7	7	0	1	1
4	9	11	— 2	— 1	2
5	9	14	— 5	— 6	1
6	16	18	— 2	— 8	— 5
7	34	20	14	6	—13
8	23	20	3	9	— 7
9	12	20	— 8	1	2
10	15	20	— 5	— 4	3
11	25	20	5	1	— 1
12	20	20	0	1	0
13	13	20	— 7	— 6	1
14	19	20	— 1	— 7	— 5
					—12

So far, the spiral and average ordinate picked out seem to fit the curve quite well. We shall go on with the same average ordinate, computing the throws as we proceed.

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
15	28	20	8	1	—12
16	25	20	5	6	—11
17	28	20	8	14	— 5
18	24	20	4	18	+ 9
19	16	20	— 4	14	27
					41

The Throw Is Excessive

At this point, we exceed the limiting throw in the positive direction. Since the first part of the curve fits so well, let us attempt to leave this part of the curve alone, and try to change the revised ordinates in such manner as to bring the 41 below 30. Let us change a few of the ordinates of 20 to 21, starting at some such place as Station 14. Try two ordinates of 21, at Stations 14 and 15, after which again change back to 20. We have

Station Number (A)	Original Ordinate (B)	Revised Ordinate (C)	Difference Between Original & Revised Ordinates (D)	Sum of Errors to and Including Station (E)	Half Throw (F)
14	19	21	— 2	— 8	— 5
15	28	21	7	— 1	—13
16	25	20	5	4	—14
17	28	20	8	12	—10
18	24	20	4	16	+ 2
19	16	20	— 4	12	18
20	8	20	—12	0	30
21	13	20	— 7	— 7	30
22	17	20	— 3	—10	23
23	17	20	— 3	—13	13
24	34	20	+14	1	0
25	18	20	— 2	— 1	1
26	13	20	— 7	— 8	0
27	10	20	—10	—18	— 8
28	32	20	12	— 6	—26
					—32

Here, again, we over run. We shall try changing some of the 20s back to 19s, starting with Station 24 (selected at random, as were the others). It is evident, by an inspection of the rate at which the column headed sum of errors is changing that we shall need three or four 19s to reduce the negative throw properly. For we are carrying a negative total of —6 in the sum of errors column. If the reader will observe the following original ordinates, he will see at once that there is an 18, a 20, another 20, before the ordinate 33 is reached at Station 32. Thus, if we have a negative throw when entering this group, and our sum of errors is negative, we shall keep on adding to the negative throw, with an almost undiminished total error, inasmuch as the three ordinates mentioned are all close to the average of the revised curve and will not materially affect the total of the sum of errors.

Inserting four 19s, Station 24 to 27, inclusive, we have the following:

Station Number	Original Ordinate	Revised Ordinate	Difference Between Original & Revised Ordinates	Sum of Errors to and Including Station	Half Throw
(A)	(B)	(C)	(D)	(E)	(F)
23	17	20	— 3	—13	13
24	34	19	15	2	0
25	18	19	— 1	1	2
26	13	19	— 6	— 5	3
27	10	19	— 9	—14	— 2
28	32	20	12	— 2	— 16
29	18	20	— 2	— 4	—18
30	20	20	0	— 4	—22
31	20	20	0	— 4	—26
32	33	20	13	9	—30
33	13	20	— 7	2	—21
34	14	20	— 6	— 4	—19
35	31	20	11	7	—23
36	22	20	2	9	—16
37	17	20	— 3	6	— 7
38	17	20	— 3	3	— 1
39	16				2
40	4				
41	8				
42	2				
43	0				

The End of the Curve

At this point, it is time for us to consider the proper spiral for the leaving end of the curve. We have reached the point where the circular curve abviously ends, and the spiral begins. We are carrying at this point only a very small throw and also a very small sum of errors, so that the total of the ordinates for our spiral will need to be almost the same as for the actual curve. Strictly speaking, it is exactly the total of the remaining ordinates of the original curve plus the sum of the errors at our last station; that is, plus 3. Let us try a spiral such as 0, 5, 11, 16, 21. This will necessitate the changing of the last shown 20 to a 21, but that will not require much additional labor. Strictly speaking, the above spiral should read, 0, 5, 11, 16, 22 (such that the differences between the ordinates, taken two at a time, will read, 5, 6, 5, 6); but such a true spiral would necessitate the installation of an ordinate of 22, which appears nowhere alse in the curve, although not objectionable from the standpoint of actual track layout. This spiral, then gives us

Station Number	Original Ordinate	Revised Ordinate	Difference Between Original & Revised Ordinates	Sum of Errors to and Including Station	Half Throw
(A)	(B)	(C)	(D)	(E)	(F)
38	17	21	— 4	2	— 1
39	16	16	0	2	+ 1
40	4	11	— 7	— 5	3
41	8	5	3	— 2	— 2
42	2	0	2	0	— 4
43	0	0	0	0	— 4

We have reached the end, and the total of the sum of errors column is zero, which proves that the total of the revised ordinates is the same as the total of the original ordinates. We have, however, a residual half-throw of —4, instead of the zero which is required as a condition that the curve is fully lined. It is necessary for us to change this —4 to 0. Remembering the rule given in the previous article, that when the residual half-throw at the end of the curve is *negative*, we subtract from the ordinates near the top of the curve (those having low station numbers) and add to those nearer the bottom of the curve, in such manner that the difference between the station numbers of the ordinates changed, when multiplied by the number of units change, equals the final residual half-throw. Applying this rule to the —4, we see that we must subtract one from a station somewhere, and add one to a station four stations nearer the bottom of the page. We are entirely at liberty to pick any two ordinates four stations apart; but if the reader will examine the curve, he will see that if we add to Station 27 and subtract from Station 23, we shall not introduce any more 21s or any 18s into the curve, as we would do if we picked up almost any other stations. Consequently, we shall subtract one from the ordinate at Station 23, and add one to that at Station 27. We then have the following:

Station Number	Original Ordinate	Revised Ordinate	Difference Between Original & Revised Ordinates	Sum of Errors to and Including Station	Half Throw
(A)	(B)	(C)	(D)	(E)	(F)
23	17	19	— 2	—12	13
24	34	19	15	3	1
25	18	19	— 1	2	4
26	13	19	— 6	— 4	6
27	10	20	—10	—14	2
28	32	20	12	— 2	—12
29	18	20	— 2	— 4	—14
30	20	20	0	— 4	—18
31	20	20	0	— 4	—22
32	33	20	13	9	—26
33	13	20	— 7	2	—17
34	14	20	— 6	— 4	—15
35	31	20	11	7	—19
36	22	20	2	9	—12
37	17	20	— 3	6	— 3
38	17	21	— 4	2	3
39	16	16	0	2	5
40	4	11	— 7	— 5	7
41	8	5	3	— 2	2
42	2	0	2	0	0
43	0	0	0	0	0

The final residual half-throw is now zero, and the entire curve is lined. The predominating ordinate of the revised curve is 20, with but very few variations therefrom. But the reader will doubtless see, by this time, just what a saving in throw was effected by the insertion of the two ordinates 21 instead of 20s at Stations 14 and 15, and by the four ordinates of 19 at Stations 23 to 26, inclusive. Such a slight compounding could not possibly have been obtained by the use of a transit, for, with the instrument, it would have been necessary to install a curve of 1 deg. and 45 min. for a portion of the curve, and then to have compounded the remainder to something like 1 deg. and 30 min.

Requires Less Throwing

In other words, the same effect is secured with less throwing of the actual track by means of string lining than by using an instrument. When we add to this saving in throw the greater smoothness and regularity of line obtained by having a stake at every joint in place of every 50 or 100 ft., we begin to realize the true value of the method. Every one who is familiar with practical track work knows that if a curve is out of true alinement—that is, if it has numerous sharp and flat places—the track foreman will put in too much superelevation through the flat places of the curve and too little superelevation through the sharp places in order to secure a curve which "looks well" to his eye. The result is, naturally, rough riding track or even unsafe track. If a curve is re-alined by means of a transit, and stakes set every 50 or 100 ft. (as is customary), the foreman who lines the track is almost certain to have numbers of sharp and flat places between the stakes. It is quite true that these places will be so slightly out of line at first that their presence can scarcely be detected by the eye; but it is equally certain that these defects become greatly aggravated as time passes and the effects of high-speed trains are felt.

Bulletins as an Aid in Standardization

AS A MEANS of emphasizing the importance of certain tasks and of promoting uniformity in practices, the engineering department of the Buffalo, Rochester & Pittsburgh has adopted the policy of issuing bulletins on various phases of maintenance of way work to its supervisory officers and foremen in the maintenance of way department. These bulletins, which are couched in simple language, call attention to those matters which may easily be overlooked or which constitute departures from standard practice.

In preparing the bulletins, due attention is paid to making them timely for the season of the year which follows their issuance and in all of them the thought of an orderly program for the year's work is kept in mind, together with a proper sense of proportion as to the relative importance of the many tasks confronting those in charge of maintenance work. Since many of the details of maintenance of way and signal work overlap, the bulletins are sent to the men of both of these departments and a spirit of co-operation is fostered thereby.

As a means of imparting instructions or of stimulating an interest in the proper methods of carrying on work, bulletins have the advantage of conveying the same message to all who receive them; on the other hand, they sometimes fail of their purpose because the interest of the reader is not aroused and for that reason he is apt to regard them perfunctorily. That the B. R. & P. bulletins avoid this danger is evident from a perusal of Bulletin No. 5 on the "Spring Clean-Up," a copy of which is reproduced herewith, and which was issued in the early part of April of the present year. We shall present copies of other bulletins of this series from time to time in following issues of *Railway Engineering and Maintenance.*

Additions and Betterments Expenditures in 1927

THE CLASS I railways of the United States spent $771,552,000 for additions and betterments to property and for new equipment in 1927, according to information compiled by the Bureau of Railway Economics. This was a decrease of $113,534,000 or 12.8 per cent as compared with the preceding year.

The total capital expenditures for each year since 1920 follow:

1920	$ 653,267,000
1921	557,035,000
1922	429,273,000
1923	1,059,149,000
1924	874,743,000
1925	748,191,000
1926	885,086,000
1927	771,552,000
Total	$5,978,296,000

For roadway and structures the capital expenditures amounted to $482,852,000, a reduction of $30,312,000 or 6.3 per cent as compared to 1926. Of these expenditures the amount spent for additional tracks totaled $139,175,000 in 1927, as compared with $166,758,000 in the previous year. A total of $43,742,000 went for heavier rail, $1,558,000 more than in 1926, while $16,230,332 was spent for addi-

BUFFALO, ROCHESTER AND PITTSBURGH RAILWAY COMPANY

ENGINEERING DEPARTMENT

SPRING CLEAN-UP

BULLETIN NO. 5

In preparation for the season's maintenance work, the first requirement is to clean up the property and restore normal track conditions and neatness and order which have necessarily been disturbed by the winter weather.

Start the working season right by making a first-class job of cleaning up. Don t neglect a single foot of the track and roadbed; clean the track, clean and straighten up the ballast and roadbed shoulders and dispose of scrapings by throwing them clear down the bank or using them to fill up depressions in the right of way. Burn up brush which has been cut, and in locations where brush has not been cut, gather up and dispose of the rubbish and rake up and burn under proper supervision all inflammable material which might start fires. Give special attention to conditions around stations, shops and other buildings, clean up rubbish and dirt, and where necessary dress off with fresh cinders or screenings. The Spring clean-up must include battery wells, battery chutes and the interior of toolhouses. Clean battery jars and covers, battery shelves and elevators; wipe off the shelving and clean out material bins in toolhouses; re-arrange the material in a neat and orderly manner. Clean up M. of W. Carpenter and Mason Shops, toolhouses, camp and outfit cars and put them in first-class condition. **Remember, there is a place for everything and everything should be in its place.**

While the work of cleaning up is going on, do not overlook track conditions needing attention. As the frost comes out of the ground, rough spots will develop and these must be taken care of in preference to other work so as to keep the tracks always in safe and good riding condition. **Don't take chances.** Whenever bad track conditions develop, get after them at once and do a real job so that it will not be necessary to do it over again in a few days. Then return to the work of cleaning up where it was left off.

Remember that good appearances count. It is not enough that track and structures should be safe and ride well. Our standard of neatness and clean roadbed and right of way of which we have a right to be proud must be kept up. Leaning mile posts, whistle posts and other track signs, broken down or ravelled paving around signs and structures and leaning telephone booths spoil good appearances and must not be allowed. Correct such conditions along with the cleaning up. Give particular attention to the right of way in the vicinity of signal and cut section locations. If during the winter months you have failed to bury soda cans and pieces of old fibre from insulated joints as per instructions, you should see that they are properly disposed of in the Spring clean-up.

Always keep drainage in mind. As the Spring cleaning goes on, watch for local bad drainage conditions and correct them. Give particular attention to roadbed ditches which have not been properly scoured and to conditions around road crossings. Open culverts, pipes and drain boxes and see that the outlets of drain tile are free and clear so the tile can do its work.

Remember that first-class work is what counts in maintenance. When the property has been well cleaned, the track must be spotted and lined out of face. Unless this work is done thoroughly and honestly, it is time wasted and the result of slighting this important Spring work will be felt throughout the entire working season. **Remember that line and surface go together.** Where track is badly out of line, it should be lined along with the spotting up. Don't let it go until the out of face lining is begun. Go over every foot of track when lining out of face; it all needs some touching up and if only the "worst places" are lined, the general appearance and riding quality of the track will be little improved. Give special attention to curve easements. Line all curves and easements with a string.

Next comes bolt tightening. Do a good job. **Put a wrench on every bolt and tighten it.** Don't neglect to oil bolts a few days before tightening. Replace broken or missing bolts. Joints are now full bolted; let's keep them so and it won't be necessary to take time from other work to catch up on that detail again. Drive down spikes along with the tightening of bolts and do not neglect frog, switch and guard rail bolts.

Joint inspection of switches and insulated joints by the foremen and maintainers is made during the month of April. This should be a thorough inspection and full co-operation should exist between the foreman and maintainer so that the greatest possible results are obtained, and repairs as far as possible should be made at the time of inspection. Have with you on inspection the material you are liable to need and avoid going back the second time. Anything of a nature making it impracticable to handle at the time of the inspection should be taken care of promptly following the inspection. **Remember that following up to see that the work laid out is actually done is one of the important requisites of good maintenance.**

Pick out good bright days for whitewashing the paving around track signs and wire fences, and see that the work is neatly done. Don't whitewash the paving around signals, cable posts, battery wells, standpipes, tanks or buildings.

Signal mechanisms that have been sealed for the past several months are to be opened during the month of April. When this is done, first give the mechanism a thorough cleaning, after which a careful inspection should be made of all parts; see that all the contacts have proper tension; that the adjustment is correct; that the signal blade clears to the ninety (90) degree position, but not beyond; make a careful inspection of the gaskets in the mechanism doors, be sure that their condition is such that they will properly protect the mechanism from the weather. In cleaning the mechanism, do not overlook the gear case and gear train. The main shaft bearing should be flushed with kerosene, after which it is to be re-lubricated. Number plates and blades should receive a thorough cleaning. **Cleanliness is an essential of good maintenance.**

Right of way fences should not be neglected. Restore them to normal condition by replacing broken posts, straightening leaning posts and stretching new wire where necessary. While time cannot be taken to rebuild long stretches of fence, local running repairs should be made along with other Spring work. A great improvement in appearances in many locations can be made by giving proper attention to this matter.

Keep in mind the necessity for first-class work always in maintenance, good drainage and the value of good appearances, and be guided by these principles in carrying on the Spring work. Then it won't have to be done over again later in the season and other important work will not be interrupted.

E. W. HAMMOND,
Engineer Maintenance of Way

W. L. CONNORS,
Signal Engineer.

Approved:

Rochester, N. Y.,
April 10th, 1928.

E. F. ROBINSON,
Chief Engineer.

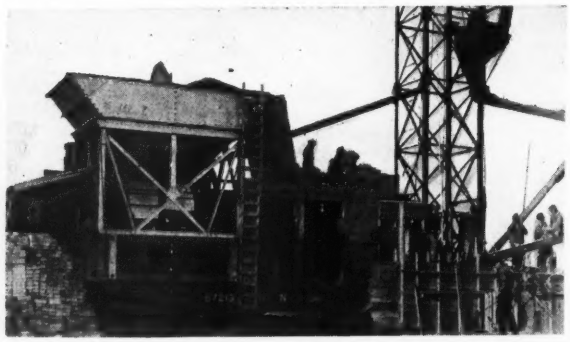
Bulletin Issued by the Buffalo, Rochester & Pittsburgh on the "Spring Clean-Up"

tional ballast in 1927 or slightly less than in the preceding 12 months.

The greatest decrease in capital expenditures was for equipment, the amount expended in 1927 being $288,700,000 or 22.4 per cent less than in 1926.

Use Standard Conveyer In Mixer Plant on Car

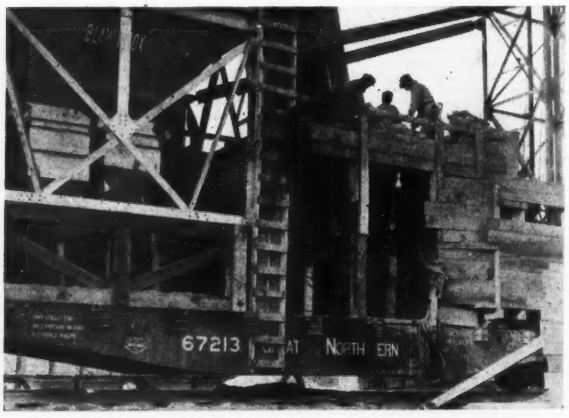
RAILROADS have frequently made use of special concrete plants mounted on cars for the construction of grade separation structures or other work for which plants of this type have been found more suitable than stationary plants from which the



A General View of the Concrete Plant

concrete must be delivered to the work by means of buckets or hoppers mounted on trucks. However, the construction of such plants has often been avoided where their use seemed advantageous, because of the special conveying equipment required.

That the construction of special conveying equipment is not necessarily involved is indicated in a plant on a car recently built by a concrete contractor at Chicago. As seen in the two photos, the plant consists of a steel frame flat car with Blaw-Knox



The Conveyor is Mounted Under the Chargers and Cement Platform

aggregate bins and measuring batchers on one end and a mixer and elevating tower at the other. Cement is stored and handled on a platform over the mixer. The delivery of the aggregates from the batchers to the mixer is effected by a short Barber-Greene belt conveyor, the cement also being dumped on the conveyor belt, which delivers both aggregates and cement into the charging hopper of the mixer. This plant averaged about 200 cu. yd. of concrete per day, but handled maximum daily runs of 250 to 300 cu yd.

The conveyor used in this plant is a self-contained unit manufactured by the Barber-Greene Company, Aurora, Ill. It is complete with motor drive, but can be had with a gas-engine drive if desired. It comprises a conveyor belt supported on a troughing carrier mounted in a structural steel frame. The receiving end of the frame is provided with a built-in hopper to feed the belt. All bearings are designed to exclude dust and are equipped for alemite high-pressure lubrication.

Slide Causes Derailment

ON OCTOBER 19, an eastbound passenger train on the Delaware, Lackawanna & Western was derailed near Hallstead, Pa. This resulted in the death of two employees and the injury of eight passengers, one mail clerk, one express messenger and four employees. This accident occurred on a four-track line and the train involved in this accident was running on track No. 2, the eastbound high-speed track. The accident occurred on a tangent at a point approximately 400 ft. from its western end.

The fill or embankment on which the accident occurred is 2,300 ft. in length. This fill was built in 1914 on ground with a slope rising gradually toward the south to a height of 200 to 300 ft., the slope of the natural ground at the point of the accident being 1 ft. in 3.7 ft. The top of the fill is 43 ft. wide and the fill is 21½ ft. deep under track No. 2. The material in the fill consists principally of rock and gravel obtained from cuts on either end. At a point about 120 ft. east of the point of derailment there is a culvert with concrete head-wall and a 24-in. cast iron pipe extending under the tracks, which was put in when the roadbed was constructed in order to take care of any surface water coming down the slope immediately south of the fill and also water coming from the top of the side-hill cut just west of the fill.

It was dark and somewhat hazy at the time of the accident, which occurred at about 6:18 p. m.

The Roadmaster's Testimony

The roadmaster stated that when he arrived at the scene of the accident about three hours after its occurrence he found that a large portion of the fill had slid out from under the tracks. There was no accumulation of water in the vicinity of the point of accident but the ground was soft and spongy where the engine came to rest. He also found that the cast-iron pipe in the culvert was amply taking care of what water was draining from the slope above the embankment, while leaves on the ground nearby indicated that the culvert had not been blocked, causing the water to accumulate against the fill. The roadmaster stated further that this particular piece of track had not required any special attention for some time before the accident.

F. L. Wheaton, division engineer, stated that the culvert was ample to dispose of any surface water which might accumulate and that there was a surface ditch to intercept any water that ran off the side of the mountain and to conduct it to the culvert without washing the side of the embankment or creating any dangerous condition. The ditch appeared to have been free and open at the time the slide occurred

and apparently was carrying all the water it was intended to carry. Mr. Wheaton expressed the opinion that there was a pocket of soft clay underneath the sod of the old natural surface of the land that had possibly become saturated and slippery as a result of continuous rains, and that the vibration of trains on the embankment caused it to give way under the embankment, carrying the embankment with it.

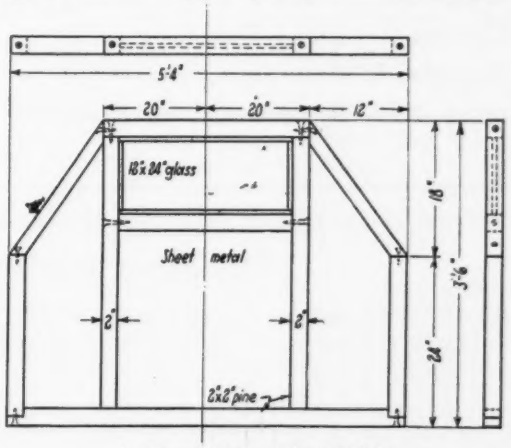
A. J. Neafie, principal assistant engineer, stated that the entire fill slid out for a distance of about 100 ft. under track No. 4 and from 100 to 125 ft. under track No. 2. He said that it had rained for three days prior to the accident and the indications were that not only was the fill thoroughly saturated with water but also that a large amount of surface water from the slope on the south side of the fill had seeped into and under the fill so as to soften the original ground surface and cause the fill to slip.

In his conclusions the director of the Bureau of Safety stated that the facilities provided for draining the water from the slope above the track were adequate for that purpose, but that as a result of continuous heavy rains the material of the fill probably had become more or less water-soaked, particularly at the point where it came in contact with the natural line of the ground, and that the softening of the material at this point, coupled with a corresponding softening of the soil of the natural ground, some of which appeared to have consisted of clay, resulted in its sliding out from under the tracks.

Two Motor Car Wind Shields

WHILE there is a difference of opinion as to the desirability of providing track motor cars with wind shields, everyone who has had to ride motor-cars in cold or rainy weather can appreciate the advantages of a suitable protection from the wind and rain and some railroads have provided wind shields for some of their motor cars or permit the users of the car to construct wind shields for themselves. Two forms of such protection are described and illustrated below. One of these is a wind shield developed by the Louisville & Nashville for use on Fairbanks Morse No. 41 cars, while the other is a home-made construction built by a track foreman on a railroad in Pennsylvania.

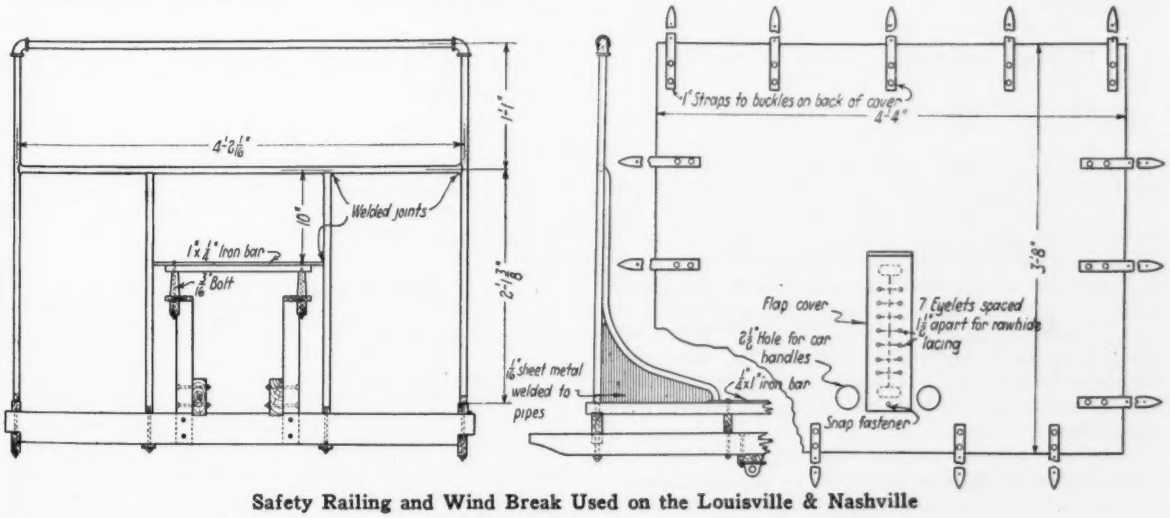
The wind break developed on the Louisville & Nashville is really a combination safety rail and wind shield. The frame or safety railing is made of 7/8 in. double-strength pipe with welded joints and firmly secured to the car sills. This frame is provided with a cover of 10-ounce water-proof duck held in place by leather straps so that it may be quickly removed or applied.



A Home-Made Wind Shield

As a consequence, this cover is used only in cold weather or during heavy rains. To avoid the objection sometimes raised to wind shields, that they obstruct the view, the safety railing has been constructed of such height that the top rail is well below the level of the eyes of a man of ordinary height sitting on the seat of the car. The function of the canvas cover, therefore, is primarily that of a wind break for the bodies of the riders, and consequently no windows are necessary. We are indebted to J. C. Nickerson, roadmaster, Louisville & Nashville, Paris, Ky., for the information concerning this construction.

The wind shield shown in the second drawing has a frame of 2-in. by 2-in. white pine sticks, held together by wood screws and bolted to a safety railing already provided on the car. It is covered with sheet metal, but as a frame is of such height as to project above the heads of the riders it is provided with a window 12 in. high by 24 in. wide, fitted with a glass pane. The information and sketch of this shield was supplied by M. C. Rich, section man at Mt. Jewett, Pa.



Safety Railing and Wind Break Used on the Louisville & Nashville

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE MAY ISSUE

1. *What attention should the section foreman give to rail anchors to insure their proper functioning at all times?*

2. *Is the loss of camber in a steel span a sign of distress? What conditions should be investigated when this occurs?*

3. *When a train carrying signals for a following section passes gangs working on the track or bridges, or passing over the track on hand and motor cars, should the whistle be sounded to call attention to these signals?*

4. *Is it practicable to salvage parts from pumps which have been scrapped? What special precautions should be taken in conditioning such parts for further service?*

5. *How can the section foreman determine the degree of a curve?*

6. *What should be the minimum amount of fill over a pipe culvert? To what extent does this vary with the diameter of the culvert and the character of the material?*

7. *What steps can the section foreman take to see that the farm gates on his section are kept closed?*

8. *What are the limitations in the use of the spray-gun for the painting of the interiors and exteriors of buildings?*

Use of Second-Hand Ties in Sidings and Yard Tracks

When treated ties released from main tracks are in sufficiently good condition for further service in sidings, should they be turned over when placed in the siding or yard tracks?

Depends on the Condition of the Tie

By R. Rossi

Supervisor on Construction, Chicago & Western Indiana, Chicago

Treated ties released from main tracks, which are in good condition for service in sidings or yard tracks, should not be turned over unless they were placed originally in the main track with the soft side of the tie down, in which case they should be turned over so that the heart side of the tie will be underneath. All second-hand ties, whether treated or untreated, inserted in sidings, should be adzed smoothly and the spike holes plugged to give a uniform bearing for the rails and to lengthen the life of the tie. In putting in ties, either new or second-hand, I always place the heart side of the tie down.

Should Be Turned if Rail-Cut or Adzed Heavily

By J. M. Sills

Division Engineer, St. Louis-San Francisco, Springfield, Mo.

If ties released from main tracks are treated and in fairly good condition except that they are cut by adzing or possibly split more or less, it certainly pays to re-use them in back tracks. In case they are removed from main tracks on account of having been adzed, causing loss of strength, it probably pays to turn them over, owing to the fact that less water will get into the timber that is not thoroughly saturated with creosote or other treatment. However, a badly cut tie of this kind, when turned over, is generally tamped in such a way that its strength will probably not be quite as great as if the tie was placed in the same way as it was in the main track.

Possibly it would be well to consider the proposition of using tie plates on these back track ties and placing the ties on their side. This will give greater strength and, if the ties are of full dimensions, will give sufficient bearing on the ballast, owing to the fact that, generally speaking, traffic is slow speed and rather light on back tracks. This idea may be worth some experimental work.

Should Usually Be Turned

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Treated ties which have been released from main tracks and which are fit for several years' additional service in sidings and yard tracks should usually be turned over when placed in such tracks. Ties which have been dapped for tie plates and which have had only two spikes driven in each end should not be turned over, but the spike holes should be plugged. This will give a better seat for the tie plates and also greater strength under heavy service, since ties break more easily under the rail when turned over. In the case of bowed hewed ties, turning them over will place the bow of the tie up when it should be down. There can be

no fixed rule which will fit all ties of this kind and it is up to the foreman's judgment as to whether or not the ties should be turned.

Should Be Turned Over

By W. C. VANDIVER

Supervisor, Louisville & Nashville, La Grange, Ky.

Ties released from main tracks which are fit for further service in yard tracks or sidings, should be turned over when so used, as the tie plates and rails have usually cut into them to such an extent that considerable adzing would be necessary if they were not turned. Since the rail in yard or side tracks is usually of a different section than that of the main track from which the ties were released, they cannot be spiked in the same places as formerly after the spike holes have been plugged, and this will weaken the tie at the place where it should be the strongest.

Should Not Be Turned

By CHARLES SANDOVAL

Section Foreman, Southern Pacific, Chandler, Ariz.

If ties released from main tracks are good enough to be used in siding or yard tracks, they should be installed face up as they came out of the main tracks. Ties are placed in main tracks "heart side down" and they should give longer service if installed the same way. Care should be taken to plug all the old spike holes and the ties should be adzed to provide a good surface for the rail or tie plates. When ties released from main tracks are to be used in sidings they should be installed as soon as possible after their removal from the main track.

Width of Ballast Shoulder

What are the advantages and disadvantages of a wide ballast shoulder? Do these vary with different kinds of ballast?

Wide Shoulders Help to Maintain Good Track

By V. H. SHORE

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

The principal advantages of a wide ballast shoulder are to hold the tracks in line and to provide a firm foundation under the ends of the ties by having sufficient shoulder beyond the ends of the ties after settlement and resurfacing to insure this.

The width of ballast shoulder depends upon the kind of ballast used: i. e., heavy ballast does not require as wide a shoulder as the lighter materials.

From 10 to 12 in. of slag or crushed stone beyond the ends of ties make a good shoulder for heavy ballasts, while the lighter ballasts require from 16 to 20 in. The only disadvantages in wide shoulders is that when the ballast becomes foul there is less chance for drainage.

There Is Usually Little Advantage in a Wide Shoulder

By ENGINEER OF TRACK

In this question it is assumed that the term "wide" is used in a comparative sense, since the width of shoulder varies with the standards of different roads as well as with the kind of ballast used. The standard ballast section of the American Railway Engineering Association provides a shoulder approximately 6 in. wide beyond the end of ties for stone ballast and approximately 12 in. for gravel, and these dimensions are found acceptable by most roads. Any greater width of shoulder is usually a waste of material except in cases where the subsidence of the roadbed requires that the track be raised frequently, in which case a wide shoulder may be provided to furnish the material for raising the track.

Where the subsidence is due to water pockets, the repeated raising of the track can be avoided by providing a proper system of drainage, but where it is due to the nature of the soil on which fills are constructed or to the settling of the material of which the fills are composed, the only thing that can be done is to raise the track when necessary and to use a wide shoulder to provide the necessary ballast. Aside from the conditions cited above, the policy of using a shoulder wider than is necessary to hold the track in line is wasteful, since it exposes the ballast to conditions which cause it to become foul, requiring additional work whenever it is necessary to clean the ballast.

The value of a few inches of additional width of ballast shoulder as an aid in holding the track in line is usually overestimated. This can be demonstrated by laying a tie on the ground, building a shoulder of gravel 12 or 15 in. long at its end, and then measuring the force necessary to move the tie so as to push the ballast ahead of it. Keeping the track in good surface will do more to maintain proper alignment than adding ballast at the end of the tie for that purpose.

Spouts for Water Columns

What are the relative merits of rigid and telescopic spouts for water columns?

Telescopic Spouts Have Several Advantages

By J. R. HICKOX

Hydraulic Engineer, Chicago, Burlington & Quincy, Chicago

The advantages of telescopic spouts over rigid spouts on water columns are as follow:

1. The water can be delivered by a telescopic spout direct to the manhole in the tender, eliminating the trouble from wind blowing the water and otherwise adapting itself better to the different heights of tenders.
2. The telescopic spout does not require as accurate spotting of the tender in order to take water. This saves time and also results in smoother stops.
3. When the valve is closed the telescopic spout drains quicker than a rigid spout, thus saving time and also reducing the amount of water that is spilled on the ground, which in cold weather forms a coating of ice.
4. Other things being equal, the telescopic crane will deliver water faster than a rigid crane on account of the longer radius curve at the top, the elimination of one right angle turn and a shorter length of small-diameter pipe.

Telescopic Spouts Are Preferred

By DIVISION ENGINEER

Telescopic spouts for water columns are generally preferred to rigid spouts, not only because they facilitate the movement of trains by reducing the time necessary to take water but also because there is less danger of their being damaged by unexpected movements of the train or locomotives at such times, thus reducing the cost of mtaintenance.

With a rigid spout it is necessary to "spot" the locomotive within close limits at the water column, in order to permit the spout to deliver water. In the case of freight trains with 25 or more cars the operating rules of the American Railway Association require that the

train be stopped and the locomotive be uncoupled from the train before taking water, but even with less than 25 cars it is often so difficult to stop within the required limits for a rigid spout, especially if the track is on a grade, that it involves less delay to stop the train and uncouple the engine before taking water. Under such circumstances, on heavy traffic lines, this results not only in delay to the individual train but to other trains.

The telescopic spout, on the other hand, has a comparatively large radius within which it can deliver water to the tender so that usually little trouble is experienced in stopping close enough to the water column to permit water to be taken with no undue delay. The telescopic spout also adapts itself to considerable variation in the height of the engine tender and this is often a matter of convenience where there is a considerable difference in the heights of the tenders of the different types of locomotives, permitting the spout to be inserted in the manhole of the tender and thus avoiding the spilling of water on the ground where it has a detrimental effect on the track.

Inspecting Rail in Track

When going over his section, what defects in rail should the foreman look for most closely and how can he do this most expeditiously?

Presence of Rust Will Often Indicate Fractures

By J. Morgan

Supervisor, Central of Georgia, Leeds, Ala.

The foreman should look for all defects alike. The most dangerous defect we have to deal with is the transverse fissure, because it is hidden and as yet we have found no way of detecting this condition until the break occurs, when the rail often breaks in several places.

Almost all other defects in rails can be seen or can be detected readily, even when the actual defect is hidden. Fractures or cracks along the junction of the head and the web can be detected by the reddish or light brown color on the web or flange of the rail resulting from rust caused by water passing through or over a fracture in the metal and being deposited as the water passes down the web to the base. When this color is noted, if the foreman will examine the rail he will usually find a fracture under the head at the top of the web. By noting this discoloration on the rail, I find that this kind of a fracture is discovered almost as easily as those which are in plain sight.

Close Inspection Is Necessary

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Many defects in rails are not easily seen and the only safe and sure way to detect them is by walking and making a close inspection of the rail and fastenings. Broken rails and rail joints can be found in most cases from close observation from motor cars, but cracked bases, cracked webs, split heads (in their early stages), a slight breaking down of the rail head, nicked bases and many other small defects familiar to the trackman, can be detected only by inspection on foot; these are the defects he should watch for most closely.

The most difficult part of the rail to inspect is underneath the head at the top of the web. Numerous rail failures are attributable to defects at this location and these cannot be detected from a motor car. A rail-mirror that can be moved along below the rail head on each side of the rail expedites inspection for defects under the heads. The rest of the rail head, the sides of the web, and the top of the base can be inspected by walking alongside the rail, but the rail must be kept clean to insure a thorough and expeditious inspection.

Inspection Should Be Made on Foot Once a Week

By A. C. Knight

General Foreman, Delaware & Hudson, Schenectady, N. Y.

A section foreman should personally patrol his section at least once a week. His first duty is to detect and examine every broken rail to determine if the break was caused by an internal transverse fissure. If so, rail must not be left unprotected, even though spliced to permit a train to pass at slow speed, and must be changed out immediately. All other broken rails must be changed out as soon as possible.

He must next look for piped rails, which develop on tangents as well as on curves, and for half-moon breaks in the base, split heads, battered ends, and broken and cracked angle bars. He should also note places where the bolts are loose and tighten them as soon as possible.

The foreman must be familiar with the age and condition of all rail on his section, giving particular attention to the oldest rail and rail of brands which have given trouble through breakage, pipes, etc. Close examination must be given relay rails, especially where they have been transposed on curves. The foreman shall stoop down and inspect this rail underneath the ball to detect cracks which are liable to develop. All wheel-marked rails should be examined carefully and not left in the track unless it is safe to do so. He should also note where rails are creeping on account of the lack of rail anchors.

The foreman should examine carefully all knuckle and lead rails in switches and make sure that only first class rails are used in such places. On main line tracks, flange-worn rails on curves should be replaced as soon as the side wear has reached one-quarter inch. The foreman should report his findings weekly to the road-master, itemizing the different conditions of rail and noting any action taken at the time of his inspection.

Permanent Markers for Right-of-Way

To what extent should permanent markers be set for right-of-way lines outside of station grounds? What is the best type of marker for this purpose?

Should Be Set at All Changes in Width

By Division Engineer

Permanent markers should be set at all points on the right-of-way where the width changes and also at sufficient intervals to define the right-of-way line where the alinement of the track has been changed from its original location. The deeds for right-of-way often specify a certain distance from the center line of the main track or tracks as located or constructed and in the case of slight revisions of alinement which do not require additional right-of-way, the markers should be set before the track has been shifted, care being taken to set them opposite the beginning and end of all curves. This procedure will often save misunderstanding after the alinement has been changed, as well as the time necessary to retrace the old line in case of a dispute as to the proper location of the ownership line. When additional right-of-way is purchased, its outlines should be marked by stakes and permanent markers placed as soon as possible after the transfer of the land to the railroad has been completed. These markers may be made either of concrete or of pieces of old rail. The

American Railway Engineering Association has prepared plans for a property line post made of reinforced concrete, which is five feet long and seven inches square at the bottom, tapering to five inches square at the top. This marker is to be set three feet in the ground, the portion above the ground having the words "Property Line" moulded in the concrete on one side of the post while on the opposite side the initials of the railroad are shown in the same manner. Where pieces of rail are used for this purpose the length is usually five feet, with two feet above the surface. If desired, the marker can be painted or the initials of the road cut into the metal with a punch. These rail markers are low in cost, since they can be cut from scrap rail, are easy to transport and to install, and in many ways are as satisfactory as the concrete posts.

Usually Necessary Only at Jogs in Right-of-Way

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Permanent markers for property lines outside of stations are usually set only at jogs in the right-of-way lines. This should be sufficient. Ordinarily, the right-of-way outside of station grounds is 100 ft. wide for single or double tracks, except where high fills, deep cuts or borrow pits necessitate a wider right-of-way for some distance, causing a jog in the property line. These jogs made from any cause should be marked. Markers made from short pieces of scrap rail are most widely used for this purpose.

Preboring Sway Brace Bolt Holes

Is it practicable to bore holes for sway brace bolts in piles and sway braces before the timber is treated with preservatives?

Many Conditions Render This Impracticable

By L. H. Harper

Superintendent Creosote Plant, Central of Georgia, Macon, Ga.

While it would be very desirable to bore these bolt holes in the piles before treating them, it does not seem practicable, since it would be necessary to determine in advance the penetration of each pile, and this would rarely be possible. Local conditions sometimes even cause a variation in the cut-off of piles of equal length, driven in the same bent.

When piles are not straight, it is sometimes necessary to turn them a certain way to place them to best advantage in the leads, and this position can only be determined on the ground. Even a slight turn of the pile in driving would throw the bolt holes out of line. It would be more nearly practicable to bore the bracing in advance of treating, but there would be less advantage in doing so.

The Holes Would Seldom Correspond

By C. W. Spence

Bridge Foreman, New Orleans & North Eastern, North Shore, La.

It is not practicable to bore holes for piles and sway braces before treating as not one out of ten would correspond with the other after driving. In driving piles, there are certain position they have to be set in driver leads to be driven accurately and if they were bored for sway brace bolts and were turned the least bit, the holes would not be in line. Piles sometimes strike firm foundation before driven their entire length and have to be cut off, in which case the holes would be useless. Valuable time would sometimes be lost on account of trying to drive a pile so that the holes would match.

On a short trestle of about ten bents the end bents are lower than the center or channel bents. Since sway braces should be put on in proportion to the height of bents, the braces for the center bent will not fit the end bents, if bored before treating, as the holes will be farther apart for the braces on the long bents. For these reasons, it would be money thrown away to bore holes for piles and sway braces before being treated, as 90 per cent would have to be rebored. In boring timber of any kind, it is a good idea to use an auger 1/16 in. smaller than the bolt to be used so as to make the hole as air-tight as possible.

Inspection of Shop Buildings

To what extent should inspection be made of large shops to insure that pulley shafts or other accessories are not attached to structural members in such a way as to overstrain them?

Inspection Should Be Made Regularly

By C. E. Ettinger

Supervisor of Bridges and Buildings, Illinois Central, Chicago

The attachment of pulley shafts or other accessories to the structural members of shop buildings without regard to the strains imposed on such members is more apt to occur in old shops where modern machinery is being installed than it is in new buildings and frequent inspections should be made at such points to see that this practice is avoided. I know of a case where the lower chord of a roof truss, composed of two angles, placed back to back, collapsed on account of its having been drilled with slotted holes for the attachment of a bearing for a line shaft, the slotted holes having cut away a large proportion of the upper legs of the angles. The millwright and the foreman of the shop should be held responsible for such occurrences but it is up to the building supervisor or inspector to keep a check on such matters.

The improper placing of shafts and belts not only causes damage to the structure at times but also interferes with the operation of swinging sash windows installed for the purpose of ventilation. In the inspection of buildings all these things should be watched to see that they do not interfere with either the safety of the structure members or the proper use of the various parts of the building.

Co-operation Between Departments Is Necessary

By Engineer of Buildings

The best way to insure that structural members of shop buildings will not be subjected to undue strains by the attachment of shafts or other accessories is to have a full understanding with the officers of the mechanical department as to the possible results of such practices. Usually these are done thoughtlessly or from lack of understanding as to what the effects will be and the members are used because they happen to be in a convenient position.

It is a simple matter to see that permanent attachments are not made where the strains will be excessive or to have them removed before any harm has resulted but the principal thing to guard against is the unauthorized use of structural parts to support hoists for picking up machinery to be transferred from one location to another. The writer knows of several instances where hoists were attached to the lower chords of roof

trusses for the purpose of lifting heavy machines from their foundations but fortunately, in each case, the situation was discovered before the load had been applied. In each case, also, the proceeding was stopped as soon as the foreman was told of the possible results. As has been said, co-operation with the users of the building will usually suffice but care should be taken to see that the matter is understood by all concerned, supplemented by inspection from time to time as opportunity offers.

Jetting Piles on Small Jobs

What is the best method of providing a water jet for sinking piles on small jobs?

Pumps Are Mounted on Pile Driver in Some Cases

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

This will vary with the frequency with which the use of a jet is required and the knowledge of where jetting will be necessary. On the Burlington Lines West of the Missouri River, the formation is such that piles must be jetted at some point or points on every division and, to provide for this, pumps are mounted on the tender of every track driver in this territory.

Steam pumps with a 4-in. discharge are used, from which two 2-in. lines for jetting may be supplied. Wherever possible, the water for the jets is taken from the stream where the piles are driven, but when this is not practicable, for any reason, a large tank car holding from 10,000 to 12,000 gal. is used to supply water to the pump. The pump is operated by steam piped from the boiler of the pile driver. This arrangement, whereby facilities for jetting are always at hand, ready to be put into service at any time, works very satisfactorily. On other parts of the system, there is only occasional need of jetting and consequently the drivers are not equipped with these pumps, a separate installation being made for such cases as call for their services. On large projects, separate facilities are always provided where much jetting is to be done.

Jetting Is Rarely Economical on Small Jobs

By I. L. Simmons

Bridge Engineer, Chicago, Rock Island & Pacific, Chicago

Sinking piles by means of the water jet will often effect large savings where the material is favorable to its use and where the number of piles to be driven is large enough to warrant the installation of facilities for handling the work properly. On small jobs, such as are ordinarily encountered on division maintenance or betterment work, the use of the jet is rarely economical and should be used only where the cost of driving by ordinary means will exceed the cost of installing a plant to operate the jets. In many cases on division work the bridge gangs are not familiar with the use of the jet and this adds to the cost of the work.

When it is necessary to use the jet on small jobs, it usually will be found better to install a plant independent of the pile driver to avoid delay in uncoupling the hose to the jet every time the driver must be moved. Another feature which often adds to the cost of jetting is the necessity of providing an abundance of water for the operation of the jet, and where such a supply cannot be obtained readily at the site of the work it often causes a considerable outlay. For these reasons the jet should be used on small jobs only as a last resort when it is impossible to drive piles by the ordinary methods.

Rail Production Decreased in 1927

THE production of steel rails in the United States in 1927 was approximately 12.5 per cent smaller than in the preceding year, according to figures compiled by the American Iron and Steel Institute. The total output of 2,806,390 tons in 1927 was 411,259 tons smaller than that in 1926 and was also smaller than for 1916, 1917 and 1923, but, with these exceptions, it exceeds that of any year since 1913.

That the trend toward heavier rail is becoming accelerated is indicated by the fact that while the total production decreased over 400,000 tons as compared with 1926, the decrease in tonnage of rails weighing 100 lb. per yard or heavier amounted to only 34,492 tons. To express it in another way, this classification constituted 68.8 per cent of the total output in 1927, as compared with 61.1 per cent in 1926. In the statistics for 1927 the classifications for the heavier sections have been changed by showing in one column rails weighing 100 lb. and less than 120 lb., with another column for rails weighing 120 lb. and over.

That the demand for Bessemer rail for railroad purposes has almost entirely disappeared is shown by the fact that the 1927 production totaled only 1,566 tons, as compared with 12,533 tons in the previous year, and by the further fact that the output in 1927 was confined to rails weighing less than 50 lb. to the yard.

Production of Rails by Processes, Gross Tons, 1912-1927

Years	Open-hearth	Bessemer	Rerolled*	Electric	Total
1912	2,105,144	1,099,926	119,390	3,455	3,327,915
1913	2,527,710	817,591	155,043	2,436	3,502,780
1914	1,525,851	323,897	95,169	178	1,945,095
1915	1,775,168	326,952	102,083	.....	2,204,203
1916	2,269,600	440,092	144,826	.....	2,854,518
1917	2,292,197	533,325	118,639	.....	2,944,161
1918	1,945,443	494,193	101,256	.....	2,540,892
1919	1,893,250	214,121	96,422	50	2,203,843
1920	2,334,222	142,899	126,698	297	2,604,116
1921	2,027,215	55,559	96,039	5	2,178,818
1922	2,033,000	22,317	116,459	.....	2,171,776
1923	2,738,779	25,877	139,742	118	2,904,516
1924	2,307,533	16,069	109,730	.....	2,433,332
1925	2,691,823	9,687	83,747	.....	2,785,257
1926	3,107,992	12,533	97,124	.....	3,217,649
1927	2,717,865	1,566	86,959	.....	2,806,390

*Rerolled from old steel rails.

Production of Rails by Weight Per Yard, 1914-1927

Years	Under 50 pounds	50 and less than 85	85 and less than 100	100 and less than 120	120 pounds and over	Total gross tons
1914	238,423	309,865	868,104	528,703		1,945,095
1915	254,101	518,291	742,816	688,995		2,204,203
1916	295,535	566,791	1,225,341	766,851		2,854,518
1917	308,258	882,673	989,704	763,526		2,944,161
1918	395,124	665,165	888,141	592,462		2,540,892
1919	263,803	495,577	965,571	478,892		2,203,843
1920	489,043	433,333	952,622	729,118		2,604,116
1921	211,568	214,936	902,748	849,566		2,178,818
1922	265,541	274,731	728,604	902,900		2,171,776
1923	272,794	300,907	864,965	1,465,850		2,904,516
1924	191,046	213,274	853,431	1,175,581		2,433,332
1925	163,607	219,648	765,371	1,636,631		2,785,257
1926	197,260	256,287	797,662	1,966,440		3,217,649
1927	161,740	173,257	539,445	1,314,424	617,524	2,806,390

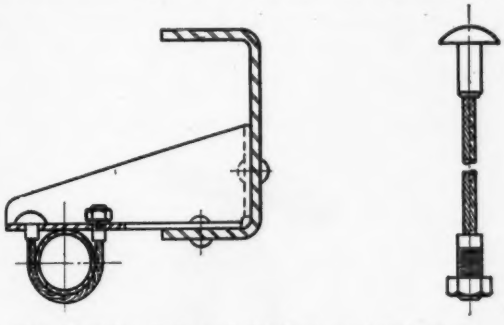
Production of Alloy-Treated Steel Rails, 1918-1927

	Production by alloys			Production by processes		Production by weight per yard			
Years	Total production gross tons	Titanium	Other alloys	Openhearth and electric	Bessemer	Under 50 lbs.	50 and under 85 lbs.	85 and under 100 lbs.	100 and under 120 lbs.	120 lbs and over
1918	3,111	2,891	220	3,111	.....	....	47	2,640	424	
1919	6,476	6,207	269	6,476	.....	....	....	3,920	2,556	
1920	12,909	11,652	1,257	12,909	.....	....	514	5,069	7,326	
1921	6,276	2,804	3,472	6,276	.....	....	71	4,277	1,928	
1922	3,163	2,493	670	3,163	.....	....	321	835	2,007	
1923	2,142	346	1,796	2,142	.....	....	56	317	1,769	
1924	5,167	1,696	3,471	5,167	.....	....	....	847	4,320	
1925	4,009	1,616	2,393	4,009	.....	70	47	.....	3,892	
1926	4,216	1,099	3,117	4,216	.....	....	42	1,027	3,147	
1927	1,265	.....	1,265	1,265	.....	....	....	374	391	500

New and Improved Devices

American Cable Company Develops a Flexible Bolt

THROUGH the development of the preformed type of wire rope which makes possible the attachment of fittings by the processing method that compels the fitting to become an integral part of the rope, the American Cable Company has recently perfected the Tru-Lay—Tru-Loc flexible bolt illustrated

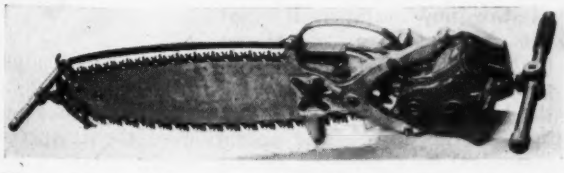


The Flexible Bolt and Method of Application

by the drawing. These new bolts may be used in many places, particularly where rigid U-bolts are impracticable. Among suggested uses are suspension brackets for overhead steam or water piping, shackle bolts for temporary wall boxes, tanks, etc., supports for scaffolding and tackle, and other applications for which semi-flexible connections are necessary.

An Air-Driven Portable Timber Sawing Machine

THE Reed-Prentice Corporation, Worcester, Mass., which last year brought out the Wolf portable timber sawing machine driven by an electric motor, as described on page 261 of the June, 1927,



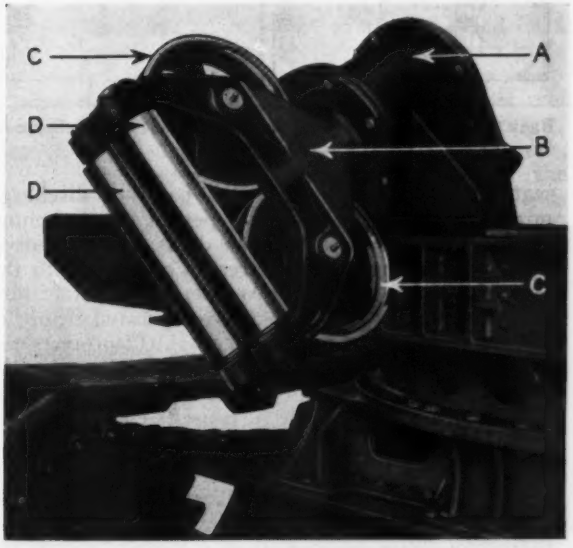
The Wolf Air-Driven Portable Timber Sawing Machine

issue of *Railway Engineering and Maintenance*, has now devised a similar unit to be driven by compressed air. An Ingersoll-Rand, Type-A air motor transmits the power to the operating mechanism and with the exception of the motor, throttle, housing and gears, the machine is identical in design and construction with the electric unit.

The machine has a capacity up to timbers of 24-in. diameter and weighs 95 lb. A minimum air pressure of 80 lb. and a volume of 70 cu. ft. per min. are necessary to insure satisfactory operation. It is said that with 90 lb. pressure a 12-in. by 12-in. timber can be cut in 40 sec. It is also said that piles have been cut off with this machine at a depth of 40 ft. under water.

A New Dragline Fairlead

THE Northwest Engineering Company, Chicago, has developed a new fairlead for dragline service. This is designed for the Type M machines, Models 104 and 105, manufactured by that company. The chief feature of this fairlead lies in the reduction of



The New Northwest Fairlead

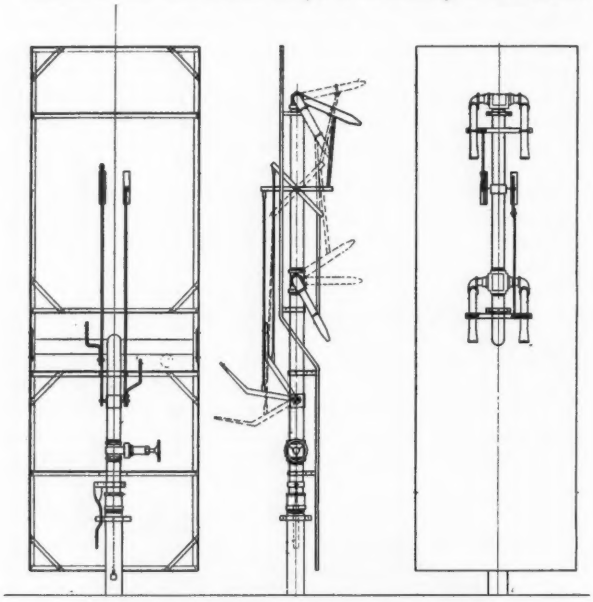
wear on the drag cable. This cable can lead to either side of the machine to an angle of 75 deg. without rubbing or scraping in any way on anything. It is in contact with but one sheave at a time and as the sheaves are large, there is a minimum amount of bending.

The fairlead consists of a rigid steel housing A

bolted to the rotating base casting. This is bored to receive two races of roller bearings in which the rotating portion B turns. Section B carries two sheaves C-C and two rollers D-D. The drag cable passes between D-D, C-C, and through B and A, which are hollow to receive it. As the angle of the cable swings, the fairlead rotates to suit. The rollers D-D take the momentary sideways push and the sheaves guide the final pull.

The Poage Stock Drencher

IN ORDER to overcome the ineffective, and in many instances, crude methods of wetting down live stock in transit, the American Valve & Meter Company, Cincinnati, Ohio, has put on the market a special unit for this class of service, known as the Poage stock drencher. This device, which is made in types for operation either between parallel tracks or on one track only, is in reality a miniature



Back, Side and Front Elevation of the Poage Style A Stock Drencher

water column fitted with two pairs of discharge nozzles, so arranged that they permit the drenching of stock simultaneously in both decks of double-deck cars, or directing all four streams of water into the deck of a single-deck car. Another important feature of the new drencher is that it is operated from the ground level, and a special metal shield protects the operator from becoming wet.

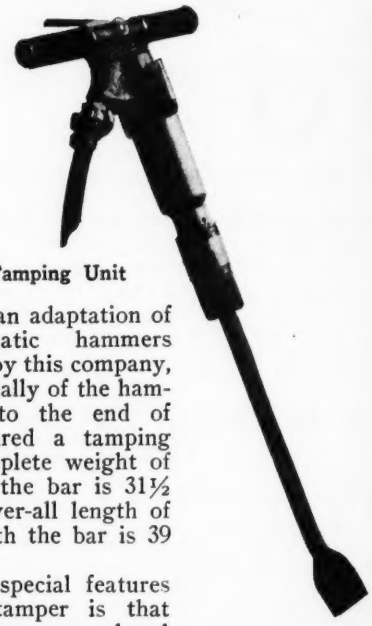
Specifically, the Poage drencher for double-track operation, known as style A, consists essentially of a three-inch vertical pipe column, mounted on a swivel, water-tight casting at the base, so that the entire column can be turned through an angle of 180 deg. Mounted on the column itself are two pairs of drenching nozzles, one pair at a height suitable for wetting down stock in single-deck cars, and the other pair located at the top of the column for directing the water into the upper decks of double-deck cars. Each pair of nozzles is operated separately and can be discharged into a car through a vertical range of about 90 deg.

The nozzles themselves consist of short sections of pipe with flattened discharge ends, so as to give a flat, diffused spray of water over a considerable area within the car and preclude the directing of a heavy stream directly on the live stock. Operation of both sets of nozzles is accomplished through hand levers located within easy reach from the ground. Similarly, the entire drencher can be turned from one track to the other from a position on the ground, thus precluding the necessity for a platform of any kind.

In order to protect the operator against the backsplash of water from the side boards of the cars, the drencher is fitted with a broad, galvanized steel shield, mounted on a sturdy steel frame, which extends from the top of the column to within about a foot of the ground. This shield is fixed rigidly to the vertical column, revolving with it as the column is rotated from one position to another, and is fitted with an opening, covered with heavy glass to give the operator a view of the work. As set up between tracks, ample passing clearance is provided over each track, and a hasp arrangement in the rotating lever makes it possible to lock the drencher with the shield parallel with the tracks when not in use. The style B Poage drencher is similar in every respect to the style A drencher, except that it has a fixed vertical column and is designed for drenching stock only on one track.

A New Pneumatic Tie Tamper

AS AN auxiliary to its line of rail-car air compressor units recently put on the market, the Chicago Pneumatic Tool Company, New York, has developed a pneumatic tie tamping tool for which a number of special advantages are claimed. This



The New Tamping Unit

tool, which is an adaptation of other pneumatic hammers manufactured by this company, consists essentially of the hammer itself, into the end of which is secured a tamping bar. The complete weight of the tool with the bar is 31½ lb., and the over-all length of the tamper with the bar is 39 in.

One of the special features of the new tamper is that the handles are so placed that both hands are on the same plane. This feature permits the operator to stand with his back straight, the handle forming a support for the operator about opposite his hips. The operation of the tamper is controlled by a lever on the top of the handle which fits under the palm of one hand of the operator, and an automatic throttle valve shuts off the power automatically when the tamper is lifted from one position to another.

The new tamper operates most efficiently on pres-

sures within the range of 55 to 90 lb., and strikes approximately 3,000 blows per minute. The hammer is cushioned on both ends of its stroke, which it is claimed makes the tamper practically vibrationless. The tamping bar regularly furnished with the tamper is the standard tamping bar, ⅝ in. thick and with a 3-in. face. Other types of bars suitable for various kinds of ballast can be furnished on specification.

A New Early-High-Strength Cement

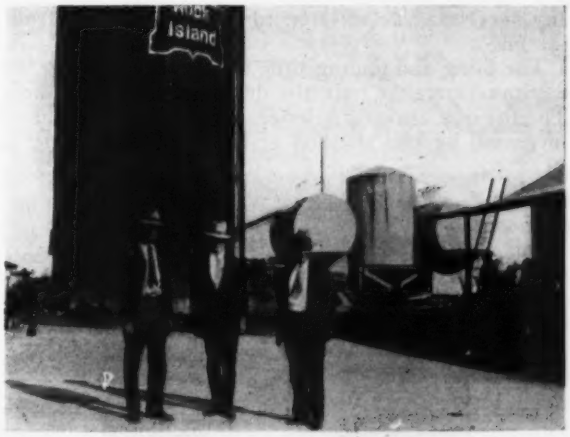
A TRUE Portland cement, which satisfies the requirements of the standard specifications for Portland cement, but which is also an early-high-strength cement, has been placed on the market by the Ash Grove Lime and Portland Cement Company of Kansas City, Mo. What is meant by early-high-strength in this connection will be understood from the reports of tests of 1-3 cement-sand mortars which gave a strength of from 288 to 360 lb. per sq. in. in tension and of from 2,769 to 3,755 lb. per sq. in. in compression at the age of 24 hours. This material is sold under the trade name of "Quickard" cement.

Switch Engine Weighing 281,000 lb. on Concrete-Supported Track 19 Hours After Work Was Completed

This high strength in so short a time is attained without any tendency toward flash setting, as the initial set in mortar specimens occurs in about three hours and the final set in about six hours. The cement is also said to satisfy requirements as to soundness as determined by tests for constancy of volume.

The cement has an advantage in that it is handled in exactly the same manner as other portland cement; in other words, practices as to proportioning of both aggregates and water, and as to mixing and placing which will insure desired results with ordinary cements are all that are required in the manipulation of this product. However, low temperatures will delay the strengthening of concrete made of Quickard cement in the same way that it delays the hardening of other cements.

This cement was used in the construction of a concrete foundation for an industry track on the Chicago, Burlington & Quincy at Omaha, Neb., where a minimum of interruption in the use of the track was of extreme importance. The concrete was mixed in the proportions of 3½ parts of premixed sand and gravel aggregate and 5¼ gal. of water per bag of cement. The character of the construction is shown in the photograph. The track was imbedded in the concrete without any cushion, yet it was placed in service only 19 hours after the last concrete was placed. The same cement was used also in the

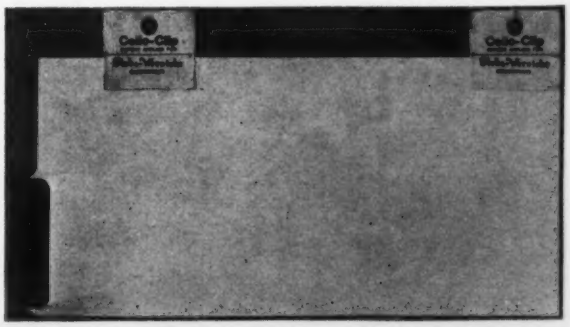


Pavement Placed in Service 24 Hours After the Concrete Was Placed

concrete for a grade crossing of a street and tracks of the Atchison, Topeka & Santa Fe at San Angelo, Tex., and in a freight house pavement for the Chicago, Rock Island & Pacific at Seminole, Okla., and in each case the concrete was subjected to regular service within 24 hours' time.

A Vertical Filing System for Drawings

A NEW method of filing drawings, maps and plans has been devised by the Globe-Wernicke Company, Cincinnati, Ohio. The system is based on a clip composed of a strip of celluloid enclosed in India rubber adhesive cloth. One end of the clip is attached by adhesion to the drawing. The other end contains a hole and slit that permit the suspending of the sheet by snapping the clip over horizontal rods. Two or more clips are used for each sheet and the sheets are strung on an assembly of polished rods that are mounted in cabinets or in open racks. Mounted on the assembly of polished rods are a set of six riders made of ply wood. These riders enable



The Clip Used for Supporting Drawings

the contents of the rack to be shifted laterally, to gain access for the removal of a drawing. The clips also serve as "handles" for the drawing, eliminating the necessity for the hands to come in contact with

the sheets when removing or replacing a drawing.

Guide cards are distributed along the rod assembly to produce a visible index. Numerical guides with green and yellow angle tabs are used to form a numerical index, and the locations of specific drawings or subdivision of the file are marked by guide cards with orange angle tabs. All sheets are visible and equally accessible, regardless of their size and any sheet may be referred to without removal from the file.

The filing and finding time is said to be held to the minimum because only the desired sheet is handled. The life of a drawing is lengthened and its usefulness increased by this method of filing, because there is

The Vertical Filing Cabinet Showing Drawings in Place

no contact between adjacent sheets, no friction when pulling out or "tucking" a sheet; neither is it necessary to thumb the corners of the sheets when searching for a specific drawing. The clip suspension is suitable for paper as well as for Ozalid and Van Dyke prints.

When the storage is in a vault, the enclosing cabinet may be omitted and the rod assemblies mounted in racks. These racks may be made to suit the dimensions of the vault.

With the Associations

American Railway Engineering Association

A meeting of the Committee on Arrangements, at which President Faucette was present, was held in Washington, D. C., on April 25, to discuss plans for the 1928 convention. Several of the committees have held meetings during the last month and interest in the work was evidenced by the number of members in attendance. The Committees on Ballast, Roadway, and Water Service, as well as one of the subcommittees of the Committee on Grade Crossings, met in Chicago on April 20.

Maintenance of Way Club of Chicago

At the meeting at the Auditorium hotel on Wednesday, April 18, a paper on highway crossing construction was presented by F. W. Hillman, engineer of maintenance of the Chicago & North Western.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

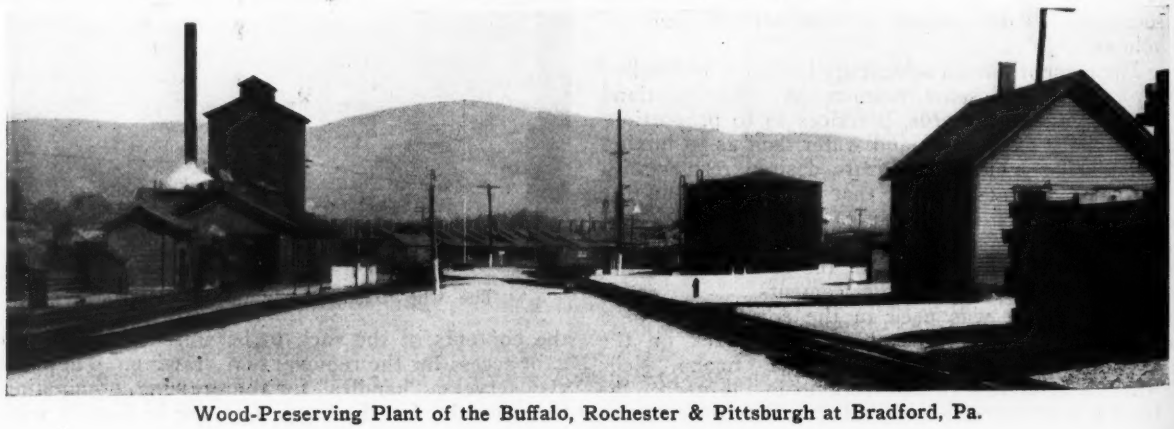
Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April, 1929.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Book Cadillac Hotel, Detroit, Mich.

Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.



Wood-Preserving Plant of the Buffalo, Rochester & Pittsburgh at Bradford, Pa.

The Material Market

HAND-TO-MOUTH buying, made possible by the improvement in railway transportation, has been responsible for marked savings in industry through the reduction in carrying charges on stock. But it has had another advantage to which less attention has been directed, namely, that of eliminating one cause for financial or industrial crises. In the old days, when all material users carried large stocks, any reduction in the sales of finished products or a weakness in prices resulted in a sudden cessation of orders and a temporary prostration of business. This was possible because dealers, jobbers and manufacturers all along the line could continue operations for some time with the stocks of materials on hand.

This is not possible today; stocks are now so small in proportion to the business done that merchants and manufacturers must continue to buy or specify shipments against contracts regardless of the general trend of demand or price levels if they are to continue their operations at all. The result is a much greater stability of business than in times past. Reductions in prices do not bring about a marked falling off in business, and advancing prices are not followed by a scramble to place new orders. Price levels are much more uniform than formerly and changes take place much more gradually. In fact, there is now no clear relation between demand and prices, and the market as a whole presents some sharp contradictions. For example, the current impression that business has been slack in recent months does not square with a record production of steel for the first three months of 1928. Furthermore, the common assumption that the past winter has seen what was clearly a buyers' market is opposed by the fact of successive advances in prices of certain commodities, for although these higher prices are not all thoroughly established, quotations on many items are now on a higher level than they were last fall.

The past month in the iron and steel market was characterized by a continuation of the *status quo*. No changes appeared in price levels of the track materials. Those on structural materials and wire products remained unchanged, although evidencing some signs of weakness, with prices in the middle west showing more strength than those in the Pittsburgh territory.

This is an off season for rail orders, although inquiries for secondary rail requirements are being made earlier than usual and some new orders have been placed, including purchases by the Burlington totaling 13,800 tons. Rail production is estimated at 90 per cent of capacity at Chicago and 80 to 85 per cent in the East, with orders on hand that will keep the mills busy at least six weeks. The production of other track supplies ranges from 75 to 80 per cent. Contracts for steel for railroad bridges have been a feature during the past month and include 18,000 tons for the Cleveland, Cincinnati, Chicago & St. Louis, 5,000 tons for the Pennsylvania, 6,000 tons for the Chicago & North Western, and 1,700 tons for the Baltimore & Ohio.

Iron and Steel Prices Per 100 Lb.

	March				April			
	Pittsburgh		Chicago		Pittsburgh		Chicago	
Track spikes	$2.70	to $2.80		$2.80		$2.80		$2.80
Track bolts		3.80		3.80		3.80		3.80
Angle bars		2.75		2.75		2.75		2.75
Tie plates, steel		2.15		2.15		2.15		2.15
Boat spikes	2.90	to 3.00	$2.90	to 3.00		3.00		3.00
Plain wire		2.50		2.55		2.50		2.55
Wire nails, keg		2.65		2.65	$2.60	to 2.65	$2.65	to 2.70
Barb wire, galv		3.35		3.40		3.35		3.40
C. I. pipe, 6 in. to 12 in., ton			36.20	to 39.20			36.20	to 39.20
Plates	1.85	to 1.90		2.00	1.85	to 1.90		2.00
Shapes	1.85	to 1.90		2.00	1.85	to 1.90	1.95	to 2.00
Bars, soft steel	1.85	to 1.90		2.00	1.85	to 1.90		2.00
Rivets, struc.		2.90		3.00		2.90		3.00
Con. bars, billet	1.90	to 2.00			1.90	to 2.00		
Con. bars, rail		1.75	1.80	to 1.85		1.75		1.85
Rails per gross ton f.o.b. mills		43.00		43.00		43.00		43.00

Scrap Prices Per Gross Ton at Chicago

	March	April
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	14.50 to 15.00	13.75 to 14.25
Rails less than 3 ft. long	15.00 to 15.50	15.00 to 15.50
Frogs and switches cut apart	13.50 to 14.00	13.00 to 13.50
Steel angle bars	14.00 to 14.50	13.75 to 14.00

The scrap market showed greater strength toward the close of the month, but did not recover fully from the depression which occurred during the earlier weeks, and prices are definitely lower than at the beginning of April.

With orders, shipments and production in most producing fields definitely in advance of last year, the lumber manufacturers are assuming a more optimistic attitude and have been able to demand better prices, and, as shown in the tables, quotations are on an upward trend. This is the first sign of an upward turn in lumber for some time, but it is of course impossible to measure its true significance at this stage.

Southern Pine Mill Prices

	March	April
Flooring, 1x4, B and better, flat	$38.00	$38.38
Boards, 1x8, No. 1	32.15	32.50
Dimension, 2x 4, 16 No. 1, common	24.00	25.47
Dimension, 2x10, 16 No. 1, common	26.75	26.75
Dimension, 2x 4, 16, No. 2, common	22.63	21.75
Dimension, 2x10, 16, No. 2, common	21.16	22.75

Douglas Fir Mill Prices

	March	April
Flooring, 1x4, B and better, flat	$24.50	$24.25
Boards, 1x8, No. 1	15.75	16.50
Dimension, 2x 4, 16, No. 1, common	17.50	18.00
Dimension, 2x10, 16, No. 1, common	17.25	17.50
Dimension, 3x 3 to 4x12, No. 1, common	18.75	19.25
Dimension, 5x 5 to 12x12, No. 1, common rough	17.00	16.75

Marked advances in the quotations on Portland cement have been made at a number of points, while the prices have remained stationary at others, these increases being confined primarily to the south and southwest. Thus, in the table shown below the quotation for New Orleans is 47 cents higher and that for Dallas 35 cents higher than given last month, but the others are unchanged. These prices are per barrel in carload lots, not including package.

New York	$2.03	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.50	Dallas	2.40
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

A Dresden-Leipzig Train at Dresden, Germany

Railway News

Briefly Told

The National Safety Council, Chicago, has offered 25 cash prizes, ranging from $50 to $3 each, to be awarded to amateur photographers who submit the best accident-prevention prints.

Eighteen months without an accident is the record achieved by the maintenance of way forces under the supervision of David Davis, track supervisor on the Williamsport division of the Pennsylvania, with headquarters at Millersburg, Pa.

Beginning April 29, the Boston & Maine's "Flying Yankee," express train between Boston and Portland, 111 miles, was scheduled to run through in 2 hours, 25 minutes, and to make the entire run without a stop, the longest non-stop run in New England.

The old timers who remember "way back when" yellow was the standard color for passenger coaches will feel that they have lost another link with the past, now that the Chicago & North Western has decided to change the color of its cars on through passenger cars from yellow to the standard Pullman color.

Governor Smith of New York has vetoed the proposed law which provided that the state should pay a portion of the cost of installing automatic signals at highway crossings, basing his disapproval on the ground that no appropriation was made for this purpose and that therefore state funds would not be available..

Revenue freight car loading for the week ending April 14 totaled 912,377, a decrease of 44,498 cars as compared with the corresponding week in 1927 and of 52,417 as compared with 1926. The cumulative total for the first 15 weeks of the current year was 13,622,943, as compared with 14,451,907 and 14,063,865 for the corresponding periods in 1927 and 1926, respectively.

Edwin Daniels, a negro at Red Banks, Miss., on being told by his children that the St. Louis-San Francisco railroad "had done broke in two," seized a red cover from a bureau and rushed to the tracks in time to flag a local train which was approaching a broken rail. R. B. Butler, superintendent of the Southern division of the Frisco at Memphis, sent Daniels a letter of thanks for his action.

The Boston & Maine has arranged with the New England Contracting Company to supply attendants at a number of highway crossings in the vicinity of Boston. Crossing watchmen in the employ of the road who enter the service of the contractor will be given leave of absence and their seniority rights and privileges will be fully protected, while those who do not care to join the contractor's forces will be placed elsewhere in the railroad service.

The maintenance of way department of the Pittsburgh & Lake Erie has been awarded a trophy for the best safety performance made in Group B on the New York Central Lines during the fourth quarter of 1927. This department ranked second for the entire year of 1927, with a decrease of 60.26 per cent in casualties, while the road as a whole had a decrease of 35 per cent in casualties. Group B is composed of the Pittsburgh & Lake Erie, the Ohio Central Lines, the Indiana Harbor Belt, the Chicago River & Indiana and the Peoria & Eastern.

A bill introduced in the Senate by Senator Dill of Washington provides that railroad employees shall not be required to work more than six days consecutively per week except when the division superintendent or some higher officer shall declare that an emergency exists, and then in no case shall an employee be compelled to work more than 13 days consecutively. The bill also provides that every employee shall be permitted at least four days of rest in each calendar month and that the monthly rate of pay shall not be decreased because of its provisions.

In the "Regulations for the Transportation Department of the Western Railroad" in 1842 is an item to the effect that "each division shall be divided into suitable sections,—to each of which shall be assigned permanently one superintendent with as many hands as the roadmaster may judge necessary for keeping said division in good running order; and each of these parties shall be furnished with a hand car for the conveyance of themselves and tools, which shall be run over their respective divisions every morning before the passing of the trains." The Western Railroad extended from Worcester, Mass., to Albany, N. Y., and is now a part of the Boston & Albany.

Transportation requirements for the second quarter of 1928 for 29 of the principal commodities are estimated at 9,035,963 cars, an increase of 323,254 cars or 3.7 per cent as compared with the loadings for the same commodities during the corresponding period in 1927. This estimate is based on information furnished to the Car Service Division of the American Railway Association by the 13 shippers' regional advisory boards. The principal increases estimated are for automobiles, trucks and parts, 28.9 per cent, and agricultural implements and vehicles other than automobiles, 10.2 per cent, while the principal decreases are for cotton, cotton seed and products, and citrus fruits, which are estimated at 21.3 per cent, 39 per cent and 21 per cent, respectively.

"When you reach home tonight, stand in front of the mirror, hand in hand with some loved one, and decide which one, if either, of your eyes you are willing to give up." This is the opening paragraph in the latest circular issued by R. G. Bentley, chairman of the Safety Section of the American Railway Association, in which the prevention of eye injuries is presented as the special topic for consideration by safety committees during the month of May. The estimated number of men blinded by accident in this country each year is 15,000, and many of these accidents could have been avoided by the wearing of goggles while within the danger zone. The manufacture of goggles has been brought to a high state of efficiency, states the circular, so that no worker is excusable for neglecting this precaution, which, with proper attention, may be made as natural as wearing gloves.

Homer Loring, who retired recently as chairman of the board of the Boston & Maine, accepted no compensation for his services during the four years in which he directed the rehabilitation of that road. On his retirement the board of directors voted him the sum of $100,000, which Mr. Loring accepted only for the purpose of establishing a fund to be administered by trustees for the general good of all employees of the Boston & Maine. The fund will be administered by a body incorporated as the Boston & Maine Railroad Employees' Fund, with a board of five trustees composed of Mr. Loring; George Hannauer, president of the company; W. Rodman Peabody, member of the board of directors; Cameron McKay, a passenger conductor on the Portland division, and Joseph M. Sullivan, passenger trainmaster of the Terminal division. Mr. Loring consented to serve as a trustee only on a temporary basis.

Construction News

The Alabama, Tennessee & Northern has awarded a contract for the construction of a freight station and agency office building at Mobile, Ala., at a cost of $71,000 to L. W. Hancock, Louisville, Ky. Construction will be of concrete brick and steel, with the freight shed 400 ft. long and outside dimensions of the agency office section of the building 60 ft. by 100 ft. The station will occupy a site leased by the railroad from the Alabama State Docks commission.

The Atchison, Topeka & Santa Fe has awarded a contract for the construction of a one-story machine and boiler shop at Guthrie, Okla., having outside dimensions of 42 ft. by 150 ft. to the H. W. Underhill Construction Company, Wichita, Kan.

A contract for the construction of two yard units at Emporia, Kan., has been let to the List & Bagwell Construction Co., Kansas City, Mo. This project involves the excavation of about 600,000 cu. yd. of earth and includes the grading of the site for new stockyards and sheep barns.

Bids have been requested by this company for the construction of a coaling station at Galesburg, Ill.

The Baltimore & Ohio has let a contract to the Hawkins Construction Company, Newark, O., for the construction of a freight house and freight handling facilities at Newark, which will cost about $100,000.

Bids closed on April 4 for the construction of a coaling station at Rossford terminal, Toledo, Ohio. The station will have a capacity for 300 tons of coal and 150 tons of sand.

The Bangor & Aroostook plans the elimination of a highway crossing at Northern Maine Junction, which will necessitate the raising of tracks over a highway. This work will be done by company forces and will cost about $45,000. It also plans to raise the bridge over the St. John river at Van Buren, Me., and to raise the tracks to take care of high water caused by the dam in process of construction at Grand Falls, Me., on the St. John river, at Van Buren and north along the St. John river, at a cost of $58,000. This work will be done by company forces.

The Boston & Maine has awarded a contract for the construction of a four-track reinforced concrete automatic electric coaling station of 500 tons capacity at East Deerfield, Mass., to the Roberts and Schaefer Company.

The Canadian National received tenders until March 31 for the construction of a water supply system at Willowbunch, Sask., and for the construction of mechanical coaling docks at Sturgis, Sask., Medstead and Hudson Bay Junction.

The Canadian Pacific, in a bill passed by the House of Commons of Canada, has been authorized to construct an extension from Nipawin, Sask., west along the Saskatchewan river about 85 miles to Prince Albert. This line will involve the construction of a bridge over the Saskatchewan river at a cost of about $1,500,000. Under the terms of the bill construction must be started within two years and the line must be open for traffic within five years.

A contract for the construction of a 100-ton coaling station at Elkhorn, Man., has been let to Macaw and Macdonald, Winnipeg, Man.

The Chicago, Burlington & Quincy has awarded a contract for the construction of a coaling station of 150 tons capacity at Stockholm, Wis., to Fairbanks, Morse & Co., Chicago. Company forces will handle the installation of a water station at the same point.

The general contract for the construction of a power plant at Fourteenth and Canal streets, Chicago, has been awarded to the Kritzer Construction Company, Chicago. A smoke stack 185 ft. high in connection with the power plant will be constructed by the Heine Chimney Company, Chicago. The total expenditure involved in this project, including machinery and equipment, will be about $200,000.

The Chicago, Indianapolis & Louisville has awarded a contract for the construction of a 500-ton reinforced concrete electric coaling station at Lafayette, Ind., to Fairbanks, Morse & Co., Chicago. A contract has been awarded to the E. B. Styles Contracting Corporation, Chicago, for the construction of the concrete abutments for a steel span over a highway at Cedar Lake, Ind.

The Chicago, Springfield & St. Louis, contingent upon the approval of the merger of this company and the Jacksonville & Havana by the Illinois Commerce Commission and the Interstate Commerce Commission, plans to expend about $1,108,000 for improvements to the roadway, buildings and terminal facilities of these two railroads. Replacement of bridges, surfacing of track and additional ballast on the 128 miles of line will require an expenditure of $237,500; new equipment and coaling stations will cost about $211,700; and the construction of new buildings, fences and similar facilities will require an expenditure of about $658,000. Included in the plans for buildings are the construction of a freight and passenger terminal at Springfield, Ill., and a general shop at either Springfield, Ill., Jacksonville or Jerseyville.

The Chicago, Milwaukee, St. Paul & Pacific has submitted plans to the city of Minneapolis, Minn., for the elevation of its tracks across 19 streets between its station and East Twenty-sixth street in that city. The cost of the project is estimated at about $4,000,000.

Bids have been received for the construction of a water treating plant at South Minneapolis, Minn.

The Chicago & North Western has awarded a contract for the construction of a concrete block and tile combined passenger and freight station at Carrollville, Wis., to Henry Danischefsky. The station will have outside dimensions of 22 ft. by 88 ft.

The Chicago, Rock Island & Pacific has awarded a contract to A. Guthrie & Co., St. Paul, Minn., for the construction of an extension of the Amarillo-Stinnett branch from Stinnett, Tex., to Gruver, 34 miles. The excavation of more than 1,500,000 cu. yd. of earth is involved in the construction of this line.

A contract has been awarded to the Railroad Water and Coal Handling Company, Chicago, for the construction of a water treating plant at Silvis, Ill. A contract for the construction of a boiler washing plant at Forty-seventh street, Chicago, has been awarded to the F. W. Miller Heating Company, Chicago.

The Delaware, Lackawanna & Western has let a contract to the Lowman Construction Company, Elmira, N. Y., for the construction of a three-story brick Y. M. C. A. building, 86 ft. by 48 ft., at Elmira, at an estimated cost of $75,000.

The Denver & Rio Grande Western has awarded a contract for the enlargement of three tunnels in La Veta Pass between Pueblo, Colo., and Alamosa, to Platt Rogers, Inc., Pueblo, at a cost of about $60,000.

A contract for the construction of water treating plants at Cisco, Utah, at Farnham, at Helper and at Green River has been awarded to the Sterans-Rogers Manufacturing Company, Denver, Colo. The plants will have the following capacities: Cisco, 15,000 gal. of treated water per hour; Farnham, 15,000 gal. per hour; Helper, 30,000 gal. per hour: Green River, 30,000 gal. per hour.

The Detroit, Toledo & Ironton has awarded a contract for the construction of the reinforced concrete abutments for four grade separation structures over highways on the Malinta-Durban cutoff in Michigan and Ohio to A. Guthrie & Co., St. Paul, Minn.

The Great Northern has awarded a contract for the construction of a one-story combined passenger and freight station at Klamath Falls, Ore., to James Quinn, Portland, Ore. Company forces have started the reconstruction of the Shevlin-Hixon logging railroad, 25 miles long, which will connect the terminus of the Oregon Trunk at Bend, Ore., with the new extension into Chemult, Ore. It is planned to inaugurate regular freight and passenger service between Klamath Falls and the Spokane, Portland & Seattle at Wishram, Wash., about May 1. A contract for the construction of a roundhouse at Klamath Falls has been let to Dunn & Baker and a contract for the construction of a steel draw bridge over Ewauna lake, near Klamath Falls, has

been awarded to the Sawmill Engineering & Construction Co.

A contract for the construction of a branch line from Saco, Mont., to Turner, about 80 miles, has been awarded to A. Guthrie & Co., St. Paul, Minn. This extension, which it is estimated will involve a total expenditure of $2,000,000, will furnish transportation to a wheat producing area near the Canadian border.

A contract has been awarded to W. T. Butler, Seattle, Wash., for the construction of a brick and steel shop at Wenatchee, Wash., for the repair of electric locomotives. The building will have outside dimensions of 82 ft. by 192 ft. and will be 50 ft. high. A contract has been let to Carl Steen, Grand Forks, N. D., for the construction of an extension to the round house at Grand Forks.

The Green Bay & Western has awarded a contract to the Zenith Dredge & Dock Co., Duluth, Minn., for the construction of a 40 ft. by 600 ft. frame and pile dock at Green Bay, Wis., at a cost of about $150,000. This project involves the excavation of about 100,000 cu. yd. of earth.

The Illinois Central has awarded a contract to Jos. E. Nelson & Sons, Chicago, for the construction of a water treating plant at Stoneport, Ill., which will have a capacity of 150,000 gal. per day. The plant will be equipped with pumps capable of handling water at the rate of 500 gal. per minute.

The Maine Central closed bids on March 26 for the construction of a new passenger station, freight house and freight yard at Ellsworth, Me. The work involved will cost approximately $109,000.

A contract for the construction of two steel buildings, involved in the remodeling of the paint shop and the construction of a paint store and car shop at Waterville, Me., has been awarded to the Truscon Steel Company, Boston, Mass. The contract for the construction of brick walls and foundations in the project has been awarded to the John H. Simonds Company, Portland, Me. The total cost will be about $62,000. This road has authorized the installation of extensions of the second and third sections, to a depth of 90 ft., of its engine house at Bangor, Me., at a cost of approximately $40,000.

The Missouri Pacific has reached an agreement with the city of St. Louis, Mo., under which they will share equally the $149,200 cost of the construction of a viaduct to carry the Missouri Pacific tracks over Wellington avenue in St. Louis.

A contract for the realinement of track at various points between Nepesta, Colo., and Sugar City, 33 miles, and for raising the track at a number of points between La Crosse, Kan., and Hoisington, 32 miles, has been let to Arthur and Allen, Pueblo, Colo. The total cost of the work, including the relaying of rail, is expected to be about $325,000.

The New York Central let a contract to Babor-Comeau & Co., Inc., New York, for the construction of a poultry terminal building and platform at Port Morris, N. Y. A contract has also been let to the Walsh Construction Company, Syracuse, N. Y., for the reconstruction of bridges 270 and 272 at Tarrytown and Tivoli, N. Y., respectively.

The New York, New Haven & Hartford has given a contract for the extension of its facilities at Van Nest Shops, New York City, to Babor-Comeau & Co., Inc., New York. The work involves the construction of a brick and steel structure, 106 ft. by 376 ft. The cost of the project will be about $250,000. The company has also awarded a contract to W. V. Polleys Co., East Providence, R. I., for improvements at Fox Point Wharf, Providence, R. I., to replace the office and freight shed occupied by the Merchants & Miners Transportation Company, which was destroyed by fire in January. The work will include the erection of a two-story brick and timber building, a one-story shed and a 12-inch brick fire wall at the east end of the latter, and will cost about $40,000.

The Pennsylvania has let a contract to the Ready Coal & Construction Co., Chicago, for paving at the 47th street subway at Chicago, the work involved to cost $25,000. A contract has also been awarded to the Arundel Corporation, Baltimore, Md., for the construction of a new undergrade bridge at Lakewood avenue in Baltimore, at a cost of $125,000.

Sinclair & Grigg of Philadelphia, Pa., have been awarded a contract for the construction of a new coal dumper pier on the Delaware river, about a mile south of the present Greenwich terminal yard at Philadelphia. This project will cost $600,000.

The Cement Gun Construction Company, New York, has been awarded a contract for the construction of protection screens on bridges at South street, 49th, 62nd, 63rd, 65th, 71st and 72nd streets, Philadelphia, in connection with electrification from Philadelphia to Wilmington and Philadelphia to West Chester.

A contract has been awarded to the Ogle Construction Company, Chicago, for the construction of coal and ash handling facilities at the Little Creek terminal, Norfolk, Va.

A contract has been let to the T. J. Foley Company of Pittsburgh, Pa., for masonry work on an additional span at the north end of the Manayunk bridge over the Schuykill river at Philadelphia, Pa., to cost $42,000. A contract has also been let to this company for the construction of an overhead bridge to eliminate a grade crossing at Stony Brook, Pa., at a cost of $42,000.

The company will make additional improvements at South Philadelphia, which, together with the extension and raising of tracks and other improvements that have been under way for the past year, will be known as the South Philadelphia terminal yard. It is also considering an agreement covering extensive improvements at Newark. The program, including the construction of a new passenger station on the north side of its tracks and the proposed boulevard on the line of Canal Street, is to be carried out by the road in connection with plans agreed to by officials of the city, the State Highway Department and the Public Service Corporation, providing for adequate street transit facilities. On the completion of the proposed improvements, the railroad company will abandon Manhattan Transfer.

The Pennsylvania and the Lehigh Valley have advertised for bids for the construction of the superstructure of their new Newark Bay bridge. The cost of this part of the $7,500,000 project will be about $1,000,000.

The Quebec, Saguenay & Chibougamau has been organized in Canada to open up a new section of what is known as the Lake St. John district and will also make accessible the Chibougamau mining district. The company is authorized to build some 400 miles of line and three divisions are projected: the Quebec division, from a point at or near Quebec to Chicoutimi, approximately 140 miles; the Saguenay and Lake St. John division from a point at or near Herbertville to a point at or near the town of Dolbeau (Mistassini), approximately 40 miles; and the Chibougamau division, from a point at or near Dolbeau, on the Saguenay and Lake St. John division to the Chibougamau mining district, approximately 167 miles.

The Reading plans the construction of a large commercial building at Philadelphia at a cost of $3,000,000. It will be a 10-story building having an area of 1,250,000 sq. ft., or approximately 30 acres of floor space. It will be located on Broad street between Callowhill and Noble streets, and the Callowhill street freight station will remain on the track level there. Improved freight facilities will give the tracks an unloading capacity of 150 cars a day. The freight station will be entirely underground and will be the only one of its character in existence, according to officers of the Reading.

The St. Louis Southwestern will open bids on May 7 for the reconstruction of its line between Mt. Pleasant, Tex., and Tyler, 67 miles. This project involves the revision of grades and alinement at an estimated cost of $1,900,000.

The Southern Pacific plans the rearrangement of track facilities at the passenger station and coach yard at Eugene, Ore., at a cost of about $70,000.

Bids have been received by this company for the construction of a one-story brick and concrete freight station at Eagle Pass, Tex. This station, which will replace the old existing structure, will have outside dimensions of 35 ft. by 200 ft.

In a recent statement concerning improvements to the facilities at San Francisco, Cal., Henry W. de Forest, chairman of the board, announced that a preliminary investigation is under way looking toward the possible substitution of a bridge across Carquinez straits to replace the ferry boats now in use at that point. Mr. de Forest stated that the Southern Pacific is not interested in any project or plan to construct a bridge across San Francisco bay.

The Union Pacific System has appropriated $28,800,000 for maintenance of way and structures and $23,000,000 for improvements to existing property and additional construction in 1928. Included among the projects in the latter classification is the proposed construction of 10 miles of second main track on the Oregon Short Line between King Hill, Idaho, and Ticeska at an estimated cost of $675,000, enlargement and lining of tunnels for double tracking on the Los Angeles & Salt Lake, requiring an estimated expenditure of $375,000, and the expenditure of $550,000 for the completion of a $2,500,000 program of improvements at the Grand Canyon and in the Southern Utah parks region. In addition it is planned to separate the grade with highways and lengthen passing tracks at a number of points on the system. A new passenger station will be constructed at Marysville, Kan., on the Union Pacific, and at Gering, Neb., it is planned to construct a new passenger station and engine terminal in connection with the establishment of an operating headquarters at that point for the North Platte line.

Voters at Cheyenne, Wyo., on April 12 approved the issuance by that city of $200,000 of bonds for the construction of a viaduct over the tracks of the Union Pacific. The railroad will bear half of the total cost.

The Wabash and the Board of County Road Commissioners of Wayne County, Michigan, have reached an agreement extending until 1932, under which all the grade crossings of the Wabash with main highways will be eliminated. The railroad and the county are to contribute $200,000 each toward the cost of these improvements.

The Western Pacific has authorized a program of improvement and maintenance for 1928 which involves an expenditure of about $4,369,420. Included in this program is the widening of the subgrade between Oakland, Cal., and Sacramento at a cost of $160,000, the replacing of nine bridges and trestles with concrete and steel structures at a cost of $180,000, the extension of existing passing tracks and the construction of additional passing tracks between Oroville, Cal., and Portola at a cost of $310,000 and the improvement of yard tracks, depot facilities, and industrial and team tracks at division terminals. The bridge replacement program will include the construction of six steel bridges in Nevada and three steel bridges in California.

Supply Trade News

General

The American Rolling Mill Company, Middletown, Ohio, has moved its Chicago district sales office from the Peoples Gas Building, 122 South Michigan avenue, Chicago, to the Straus Building, 310 South Michigan avenue.

The W. N. Matthews Corporation, St. Louis, Mo., has opened a branch office in the Real Estate building, Philadelphia, Pa., for sales in Pennsylvania east of Altoona and in Delaware. **The E. S. Stickle Company,** Union Trust building, Pittsburgh, Pa., has been appointed representative to succeed **M. P. McClure** and will handle sales in Pennsylvania west of Altoona.

The Wrought Iron Research Association was organized at Pittsburgh, Pa., on April 5 by representatives of the leading manufacturers of wrought iron in various parts of the country, for the purpose of collecting and disseminating information concerning this metal. While wrought iron has been known since ancient times, the manufacturers feel that the public has a lack of knowledge of some of its characteristics, especially as concerns its resistance to corrosion and vibration, as well as its qualities for satisfactory welding. **L. M. Johnson,** vice-president of A. M. Byers Company, Pittsburgh, Pa., was elected president of the association, and **Snowden Samuel,** secretary of the American Swedo Iron Company Philadelphia, Pa., was elected secretary. The executive committee is made up of these two, together with **George O. Boomer,** vice-president of the Ewald Iron Company, Louisville, Ky.; **Frank W. Hamilton,** president of the Ulster Iron Works, Dover, N. J.; **J. M. Gillespie,** vice-president of the Lockhart Iron & Steel Company, Pittsburgh, Pa.; **L. E. Thomas,** president of the Reading Iron Company, Reading, Pa., and **William C. Wolfe,** manager of the Highland Iron & Steel Company, Chicago. The headquarters of the association will be at Pittsburgh.

Personal

George E. Titcomb, vice-president of the McMyler-Interstate Company, Bedford, Ohio, died on April 1.

Harry Woodhead has been appointed general manager of the hydraulic pressed steel division of the Truscon Steel Company, Youngstown, Ohio, with headquarters at Cleveland, Ohio.

W. L. Brown has been appointed manager of the branch distributing warehouse which the Cyclone Fence Company, Waukegan, Ill., has opened at 635 Genesee street, Buffalo, N. Y.

J. B. Harris has been appointed manager of the newly established branch office of the W. N. Matthews Corporation at Philadelphia, Pa., and **A. L. Link** has been appointed representative for the state of New York west of, but not including, Albany, N. Y., with headquarters at 40 West Seneca street, Buffalo, N. Y.

H. A. Schaffer, who has been conservation engineer of the Portland Cement Association for the last nine years, has been appointed Eastern sales manager of the Bates Valve Bag Corporation, Chicago, with headquarters at the company's offices in New York City and Nazareth, Pa. Mr. Schaffer, who has been identified with the cement industry in various capacities for over thirty years, served as chief chemist for the Vulcanite Portland Cement Company and afterwards became chief chemist

H. A. Schaffer

and manager of the Northampton Portland Cement Company. From 1914 to 1918 he was a member of the firm of Harrison & Schaffer, consulting engineers, specializing in mill engineering and chemical problems, and in the latter year was called to Washington to serve as assistant to the director of the Building Materials Division of the War Industries Board. Shortly after the close of the war Mr. Schaffer was appointed conservation engineer of the Portland Cement Association, which position he was holding at the time of his recent appointment as Eastern sales manager of the Bates Valve Bag Corporation.

Edgar S. Ross, for the past five years senior fellow in the roofing fellowship at the Mellon Institute of Industrial Research, Pittsburgh, Pa., has resigned and has been appointed manager of research and development for the Headley Good Roads Company, Philadelphia, Pa., in which position he will devote his time to promotional and development work in connection with the emulsified asphalt products manufactured by that company.

Matt Brodie, manager for Asia for the Sullivan Machinery Company, Chicago, with headquarters at Tokyo, Japan, died on March 25 from pneumonia, following an operation for appendicitis. Mr. Brodie was born at St. Paul, Minn., and entered the employ of

the Sullivan Machinery Company in 1902, immediately after graduating from the Massachusetts Institute of Technology. After having been advanced to manager of the Salt Lake City (Utah) office he was assigned to foreign duty and spent eight years in Australia, where he organized and conducted the Sydney branch office. In 1916 he was sent to Russia, where he assumed direct charge of the company's interests there, returning to America after the Russian revolution. Shortly thereafter Mr. Brodie was sent to Japan and for the last ten years was manager of the company's business in Japan, China, India, and other Asiatic countries.

Trade Publications

Compressors and Vacum Pumps.—The Ingersoll-Rand Company, New York, has issued a 44-page bulletin, Form No. 3150, concerning its ER and FR air compressors and vacuum pumps, which are made in small and intermediate sizes. Full descriptions of these machines are given and the various units are shown in illustrations, together with views of the component parts. The bulletin is well printed on a good quality of paper.

Pneumatic Tools and Accessories.—The Chicago Pneumatic Tool Company, New York, has issued an attractively printed catalog of 70 pages covering the various pneumatic tools and accessories which it manufactures. These products include riveters, drills, clay diggers, demolition tools, air hoists, etc., and illustrations of the various tools are given, supplemented in many cases by sectional views to make clear the details of construction.

Titanium in Rail Steel.—The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., has issued an instructive 26-page bulletin on the subject of ferro carbon-titanium in basic open-hearth rail steel, dealing with the method of application of titanium, its effect on the steel, and the wear of titanium treated rails. It also includes detailed service records of titanium treated rails, showing the effect of the treatment in minimizing the various class of rail failures.

Portable Air Compressors.—The Ingersoll-Rand Company, New York, has just published the sixth edition of its 140-page book entitled, "100 and 1 Ways to Save Money with Portable Compressors," of which 125,000 copies of the various editions, printed in several languages as well as in English, have been placed in the hands of readers. In this edition, which is attractively made up in two colors and illustrated with about 300 photographs, the company has embodied comparative cost data on its portable air compressors and air-operated tools, such as rock drills, paving breakers, clay diggers, backfill tampers, grinders, hoists, riveting hammers, chippers, metal drill, etc. The information has been put together for ready reference purposes in the cross-index form.

Personal Mention

General

E. B. Sloan, chief engineer of the Southern Pacific of Mexico, with headquarters at Guadalajara, Jal., has been appointed also assistant to the president.

N. H. Bogue, chief engineer and superintendent of the Oregon, California & Eastern, with headquarters at Klamath Falls, Ore., has been promoted to general manager and chief engineer, with headquarters at the same point.

Ray C. Harrison, purchasing agent of the St. Louis & O'Fallon and the Manufacturers Railway, with headquarters at St. Louis, Mo., has been elected purchasing agent and secretary of these roads with the same headquarters.

H. J. Hadden, purchasing agent of the Chicago, Springfield & St. Louis and the Jacksonville & Havana, with headquarters at Springfield, Ill., has been appointed assistant to the general manager with headquarters at the same point.

H. C. Murphy, on the staff of the general manager of the Chicago, Burlington & Quincy, Lines East of the Missouri river, and an engineer by training and experience, has been promoted to superintendent of the Centerville division with headquarters at Centerville, Ia.

Engineering

W. A. Kingman has been appointed office engineer for the Eastern lines of the Atchison, Topeka & Santa Fe at Topeka, Kan., succeeding **H. L. Hunter,** who has been assigned to other duties.

E. H. Piper, division engineer on construction of the Ft. Worth & Denver South Plains, has been appointed district engineer, maintenance of way of the Wyoming district of the Chicago, Burlington & Quincy, with headquarters at Alliance, Neb., to succeed **R. L. Sims,** who has been transferred to the Illinois district, with headquarters at Galesburg, Ill., restoring the former arrangement on that district whereby it was divided into two parts in so far as maintenance of way matters are concerned.

John G. Taylor, special engineer on the St. Louis-San Francisco, with headquarters at Springfield, Mo., has retired under the company's pension regulations after a continuous service of almost 48 years with that road. Mr. Taylor was born on March 2, 1864, at Cincinnati, Ohio, and entered railway service in 1878 as a water boy for an extra gang at Alton, Ill. In April, 1880, he entered the service of the Frisco as a flagman on a survey party near Wichita, Kan., afterwards being promoted to resident engineer, in which position he served on various divisions. In 1904, he was promoted to division engineer at Springfield, Mo., and was transferred to Joplin, Mo., in the following year. In 1910 he was promoted to district engineer at Monett, Mo., and was transferred to Springfield in 1912. Mr. Taylor entered the operating department in 1918 as superintendent of the Ozark division, with headquarters at Springfield, and later was transferred to the Western division with headquarters at Enid, Okla. He returned to the engineering department in 1920 as division engineer at Sapulpa, Okla., and in 1924 was promoted to special engineer, which position he was holding at the time of his recent retirement.

Frederick E. Morrow, assistant chief engineer of the Chicago & Western Indiana and the Belt Railway of Chicago, has been promoted to chief engineer of these roads, succeeding, in that capacity, **E. H. Lee,** who has heretofore been president and chief engineer and who was re-elected president on April 3.

Mr. Morrow was born on October 27, 1880, at Kokomo, Ind., and graduated from Purdue University in 1904. He entered railway service as a rodman on the Chicago & North Western in November, 1904, and was advanced successively to instrumentman and assistant engineer. In 1910 he became a field engineer in the division of roadway and track with the Board of Supervising Engineers of the Chicago Traction Lines, on the rehabilitation of that property. In April, 1910, he was appointed office engineer of the Chicago & Western Indiana and in March, 1913, was promoted to principal assistant engineer. On September 1, 1915, he was further promoted to assistant chief engineer of the C. & W. I. and the Belt Railway of Chicago, which position he held until his recent promotion to chief engineer, with the exception of the period of federal control when he was chief engineer during the time Mr. Lee was corporate president.

Frederick E. Morrow

H. M. Righter, division engineer on the New York district of the Erie, with headquarters at Jersey City, N. J., has been promoted to engineer maintenance of way of the Western district, with

headquarters at Youngstown, Ohio, to succeed **H. Knight**; and **F. S. Wheeler**, division engineer on the Eastern district, with headquarters at Salamanca, N. Y., has been transferred to Jersey City to succeed Mr. Righter. **J. G. June**, division superintendent, with headquarters at Huntington, Ind., and formerly a division engineer on the Erie, has been appointed division engineer at Salamanca to succeed Mr. Wheeler.

L. M. Swoap, whose promotion to assistant division engineer of the Erie, with headquarters at Meadville, Pa., was noted in the April issue, was born on January 7, 1896, at Kane, Pa., and graduated from Allegheny College in 1917. He entered the service of the Erie on January 23, 1918, as head of the engineering corps at Huntington, Ind., where he remained until October, 1921, except for a portion of 1918 and 1919, when he was in the U. S. Army. In October, 1921, he was transferred to Marion, Ohio, and in August, 1922, was transferred back to Huntington. On April 16, 1927, he was promoted to assistant engineer at Huntington and held this position until his recent promotion.

Asa H. Morrill, engineer of construction and chairman of the valuation committee of the Maine Central, with headquarters at Portland, Me., has been promoted to chief engineer, with headquarters at the same point, to succeed **Bertrand T. Wheeler**, deceased, and the office of engineer of construction has been abolished. **Clinton A. Plumly**, valuation engineer, with headquarters at Portland, has been promoted to assistant to the chief engineer.

Mr. Morrill was born on October 7, 1870, at Concord, N. H., and was educated at the Massachusetts Institute of Technology. He entered railway service in June, 1892, as a clerk in the maintenance of way department of the New York, New Haven & Hartford, later serving in various other position up to roadmaster. On June 16, 1906, he became a draftsman and was promoted to assistant engineer of construction on January 19, 1907. Mr. Morrill was appointed engineer of construction and valuation engineer of the Maine Central, with headquarters at Portland, on February 1, 1913, and was holding the former position at the time of his recent promotion to chief engineer.

Asa H. Morrill

Mr. Plumly was born on February 24, 1886, at Lincoln, Me., and was educated at the University of Maine. He entered railway service in the engineering department of the Maine Central in June, 1909, and has been connected with that road continuously since that time with the exception of the period from September, 1917, to June, 1919, when he was in military service in the United States Army. He was promoted to valuation engineer in September, 1919, and was holding that position at the time of his recent promotion to assistant to the chief engineer.

Clinton A. Plumly

Changes on the Canadian National

Division engineers, who will have charge of maintenance of way and engineering on their respective territories, have been appointed on the Southern Ontario district of the Central region of the Canadian National. In filling these positions, assistant engineers in the office of the district engineer at Toronto, Ont., have been promoted as follows: **Ernest R. Logie**, to division engineer of the Belleville division, with headquarters at Belleville, Ont.; **W. E. Mellor**, to division engineer of the St. Thomas division, with headquarters at St. Thomas, Ont.; **W. A. Siegner**, to division engineer of the Stratford division with headquarters at Stratford, Ont., and **L. I. Stone**, to division engineer of the Toronto Terminals division, with headquarters at Toronto. **A. D. Cuthbert**, assistant engineer in the office of the district engineer of the Montreal district at Montreal, Que., has been promoted to division engineer of the Cochrane division of the Northern Ontario district, with headquarters at Cochrane, Ont., to succeed **James Ferguson**, who has been transferred to the newly created position of division engineer of the London division of the Southern Ontario district, with headquarters at London, Ont. **H. J. Black**, inspecting engineer in the maintenance of way department at Toronto, has been promoted to division engineer of the Hornepayne division of the Northern Ontario division, with headquarters at Hornepayne, Ont., to take the place of **H. W. Femming**, who has been transferred to the St. Lawrence division of the Montreal district, with headquarters at Monreal, Que. **H. E. Smith**, assistant engineer in the office of the district engineer of the Montreal district at Montreal, has been promoted to division engineer of the Portland division of the Montreal district.

Track

W. W. Salisbury, assistant engineer on the Missouri Pacific, with headquarters at Osawatomie, Kan., has been promoted to roadmaster on the Kansas City terminals.

O. L. Birkland, extra gang foreman on the Revelstoke division of the Canadian Pacific, has been promoted to roadmaster on the Nelson division, with headquarters at Nelson, B. C., to succeed **J. Wharton**, who has been granted a leave of absence.

J. L. McElroy, assistant roadmaster on the Chicago terminals of the Chicago & North Western, has been promoted to roadmaster with headquarters at Green Bay, Wis., to succeed **E. W. Walch**, who has been transferred to Gillett, Wis., to assume charge of a newly created roadmaster's subdivision.

Fred A. Chinquist, section foreman on the Great Northern at Minneapolis Junction, Minn., has been promoted to district roadmaster at St. Cloud, Minn., to replace **Joseph Lukoski**, who has been promoted to division roadmaster with headquarters at Minneapolis, Minn., to succeed **J. Branley**, who has retired on a pension.

F. H. Pflagging, assistant supervisor on the Pennsylvania at Terre Haute, Ind., has been appointed supervisor on Division 4 of the Long Island at Patchogue, N. Y., succeeding **J. S. Snyder**, who was transferred some time ago to Division 1 of the Long Island with headquarters at Long Island City. **Joseph Sommers**, assistant supervisor on the Pennsylvania at Pittsburgh, has been appointed supervisor on Division 5 of the Long Island, with headquarters at Hicksville.

Hood Brown has been appointed roadmaster of the Duran district of the New Mexico division of the Southern Pacific, with headquarters at Duran, N. M., succeeding **C. O. Davis**, resigned. **N. M. Wells** has been appointed roadmaster of the Tucumcari district of the New Mexico division, with headquarters at Tucumcari, N. M., to take the place of **J. B. Dinwiddie**, who has been transferred to the Alamogordo district, with headquarters at Alamogordo, N. M., to succeed **L. W. McKenzie**.

Ray Sherman, formerly acting roadmaster on the Missouri-Kansas-Texas at Waco, Tex., has been promoted to roadmaster on the Cherokee division, with headquarters at Muskogee, Okla., to replace **W. D. Sheridan**, who has been transferred to New Franklin, Mo., to succeed **V. T. Burns**, assigned to

other duties. The headquarters of **C. Lyons,** roadmaster at New Franklin, Mo., have been moved to Moberly, Mo., and those of **T. Humphrey,** roadmaster at Mokane, Mo., have been moved to St. Charles, Mo.

F. J. Parkhurst, supervisor on the Chicago division of the Nickel Plate district of the New York, Chicago & St. Louis, with headquarters at Ft. Wayne, Ind., has been transferred to the Cleveland division, with headquarters at Cleveland, Ohio, replacing **G. W.** Preston, who has been appointed roadmaster on the Middle division of the Clover Leaf district, with headquarters at Tipton, Ind., where he succeeds **J. H. Dunn,** who has been appointed supervisor at Ft. Wayne.

D. A. Sipe, general foreman on the Pennsylvania, has been promoted to assistant supervisor on the Buffalo division, with headquarters at Olean, N. Y., to succeed **F. W. Kittleberger,** who has been transferred to the Panhandle division at Newcomerstown, Ohio, to replace **A. R. DeWalt,** promoted to supervisor on the Allegheny division, with headquarters at Dunkirk, N. Y. Mr. DeWalt succeeds **C. P. Sipe,** who has been transferred to the Wheeling division at Steubenville, Ohio, to replace **F. G. Church,** who has been transferred to the Pittsburgh division at Pittsburgh, Pa., where he succeeds **F. H. Rothe,** who, in turn, has been transferred to Trafford, Pa., on the same division to take the place of **W. W. Portser,** transferred to the Eastern region. **J. M. Collins,** an assistant on an engineer corps, has been promoted to assistant supervisor on the Buffalo division at East Aurora, N. Y., to replace **G. B. Buffington,** who has been transferred to the Eastern division at Alliance, Ohio, to succeed **I. E. Long,** who has been promoted to supervisor on the Buffalo division at Struthers, Pa., to take the place of **R. H. Crew,** who has been transferred to the Pittsgurgh division at East Liberty, Pa., to succeed **J. D. Archibald,** who has been granted a leave of absence. **Harold F. Webber,** assistant on an engineer corps at North Philadelphia, has been promoted to assistant supervisor on the Trenton division with headquarters at Jamesburg, N. J., to succeed **J. L. Cranwell,** transferred to the New York division at Jersey City, where he takes the place of **J. D. Morris,** transferred to the Philadelphia division at Downington, Pa., to succeed **C. E. Lehr,** who, in turn, has been transferred to Earnest, Pa..

Bridge and Building

E. A. Riley has been appointed master carpenter on the Baltimore & Ohio with headquarters at Indianapolis, Ind., to succeed Fernandes Washem, who has retired.

Water Service

William Hill, supervisor of water service on the Missouri Pacific with headquarters at Osawatomie, Kan., has retired on a pension after 46 years service with that company.

Purchasing and Stores

H. L. Cunningham has been appointed purchasing agent of the Midland Valley and the Kansas, Oklahoma & Gulf, with headquarters at Muskogee.

C. C. McMillen, storekeeper of the Walbridge Road car department of the Ohio Central lines of the New York Central at Toledo, Ohio, has been promoted to assistant division storekeeper with headquarters at Bucyrus, Ohio.

C. S. Wetherholt has been appointed storekeeper on the Chesapeake & Ohio, with headquarters at Cane Fork, W. Va., to take the place of **W. N. Strong,** who has been transferred to Ronceverte, W. Va., to succeed **T. C. Sydnor,** resigned.

Benjamin D. Noetzel, assistant purchasing agent of the Copper Range, with headquarters at Houghton, Mich., has been promoted to purchasing agent, with headquarters at the same point, succeeding, in that capacity, **John M. Wagner,** purchasing agent and assistant treasurer, who will now devote his entire time to the duties of the latter office.

John Ball, assistant purchasing agent of the Chicago & North Western, with headquarters at Chicago, has been promoted to assistant general purchasing agent of that road and the Chicago, St. Paul, Minneapolis & Omaha with headquarters at the same place. **J. E. McMahon,** general storekeeper of the C., St., P., M & O., with headquarters at St. Paul, Minn., has been promoted to assistant purchasing agent and general storekeeper,

Obituary

William J. Gooding, division engineer on the Seaboard Air Line, with headquarters at Charleston, S. C., who had been connected with that company for more than 25 years, died at Charleston on April 17.

John M. Winger, former track supervisor on the Pennsylvania with headquarters at Logansport, Ind., who was placed on the retired list in 1924, died on April 2 at Logansport at the age of 73 years.

F. G. Prest, who retired as director of purchases of the Northern Pacific in 1924 after 44 years' continuous service with that company, died at his home in St. Paul, Minn., after an illness of less than a day, at the age of 74 years.

Harry J. Skinner, superintendent of bridges of the Spokane Falls & Northern (now part of the Great Northern), with headquarters at Spokane, Wash., from 1890 to 1896, died in that city on April 13.

Henry Root, who surveyed the first railroad line into Oakland, Cal., from Sacramento in 1869 as engineer in charge for the Central Pacific (now a part of the Southern Pacific) and in 1873 was in charge of the construction of the Central Pacific bridge across the estuary between Oakland, Cal., and Alameda, died at Oakland on February 23. Mr. Root also served as engineer in charge of the construction of Central Pacific terminals at Oakland and San Francisco.

J. M. Cowsert, supervisor of water service on the Missouri Pacific, with headquarters at Gorham, Ill., died in the Missouri Pacific Hospital in St. Louis, Mo., on January 28, after an illness of 10 days caused by heart trouble. Mr. Cowsert was born on September 27, 1880, in Hardin County, Ill. He entered railway service on the Illinois Central and a few years later entered the employ of the Missouri Pacific, with which road he remained until the time of his death.

Bertrand T. Wheeler, chief engineer of the Maine Central, with headquarters at Portland, Me., died at his home at Portland on March 20. Mr. Wheeler was born on November 25, 1863, at Lempster, N. H., and was educated at

Bertrand T. Wheeler

Dartmouth College. He entered railway service as an assistant engineer on the New York, New Haven & Hartford in 1895. From 1900 to 1902 he was superintendent of streets for the city of Boston (Mass.), re-entering the service of the N. Y., N. H. & H. in the latter year as engineer of construction. He remained in this position until 1912 and during a part of this period, from 1910 to 1912, he was also an engineer of construction on the Boston & Maine. Mr. Wheeler was appointed chief engineer of the Maine Central, with headquarters at Portland, on November 1, 1912, and held this position until the time of his death.

Thomas W. King, supervisor of bridges and buildings on the Huntington and Logan divisions of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., died in the C. & O. hospital at Huntington, on February 23, after nearly 54 years' service with that company. Mr. King was employed as a carpenter on July 1, 1874, was promoted to carpenter foreman on May 4, 1888, and was further promoted to supervisor of bridges and buildings on July 8, 1906.

4 points about ATLAS non-poisonous weed killer

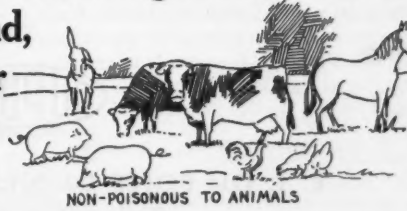
ATLAS NON-POISONOUS WEEDKILLER

1st Atlas "NP" may be used at any time during the growing season and is effective during the early part of that season, whereas arsenical weed killer may be used only after vegetation has attained a mature growth.

2nd Atlas "NP" may be applied at any time except during actual rainfall, whereas arsenical weed killer requires thirsty vegetation and should be used only after a dry period.

3rd Atlas "NP" is effective without respect to the variety of vegetation, whereas arsenical weed killer will not kill certain types, such as Horsetail and Bermuda grass.

4th Atlas "NP" is non-poisonous and permits continuous application through station grounds, farming country and grazing land, whereas arsenical weed killer can be applied only where track is properly protected from livestock.



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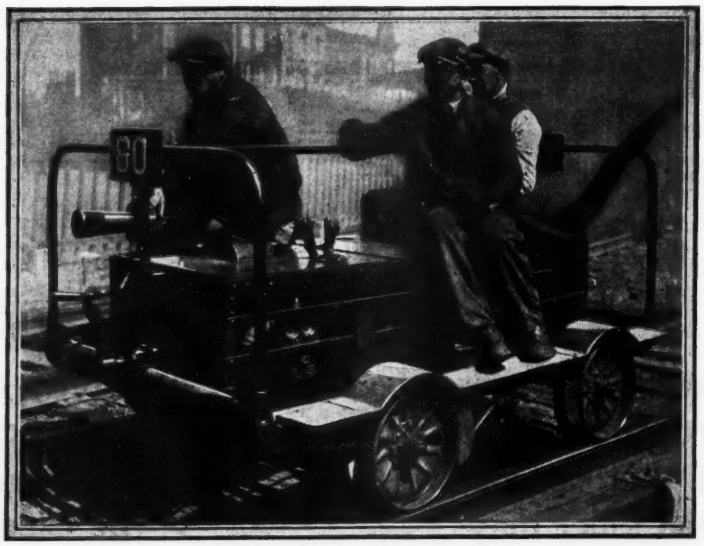

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NATURAL *Rock Asphalt on Wabash Railroad Crossing, St. Louis, Missouri.*

NATURAL *Floor, Memphis, Tenn. Dustless and durable for warehouse and shop floors.*

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STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for April 1, 1928.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. V. Wright, who, having been duly sworn according to law, deposes and says that he is the Secretary of the Simmons-Boardman Publishing Co., publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 W. Adams St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owner is:
Simmons-Boardman Publishing Co., New York, N. Y. Owners of 1 per cent or more of the total amount of capital stock are: Edward A. Simmons, New York, N. Y.; Henry Lee, New York, N. Y.; Cecil R. Mills, New York, N. Y.; George Slate, New York, N. Y.; Roy V. Wright, New York, N. Y.; Thomas Prosser & Son, New York, N. Y.; Herbert L. Aldrich, New York, N. Y.; Samuel O. Dunn, Chicago, Ill.; Carrie E. Dunn, Chicago, Ill.; Lucius B. Sherman, Chicago, Ill.; Elmer T. Howson, Chicago, Ill.; Frederick H. Thompson, Cleveland, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

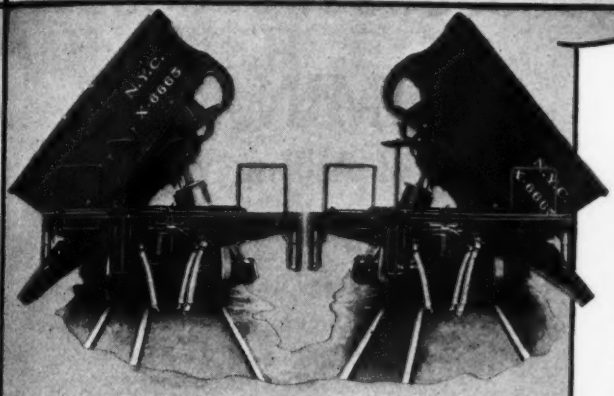
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

R. V. WRIGHT,
Secretary.

Sworn to and subscribed before me this 22nd day of March, 1928.

[SEAL] H. D. NELSON,

(My commission expires March 30, 1929.)



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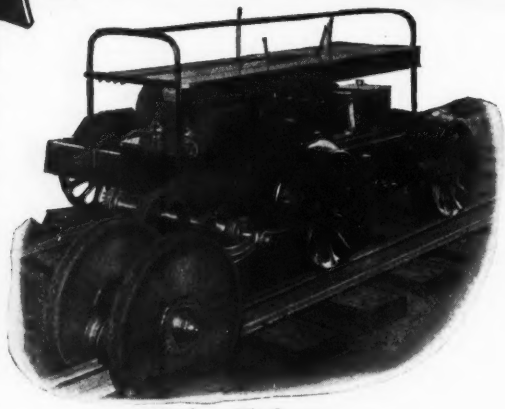

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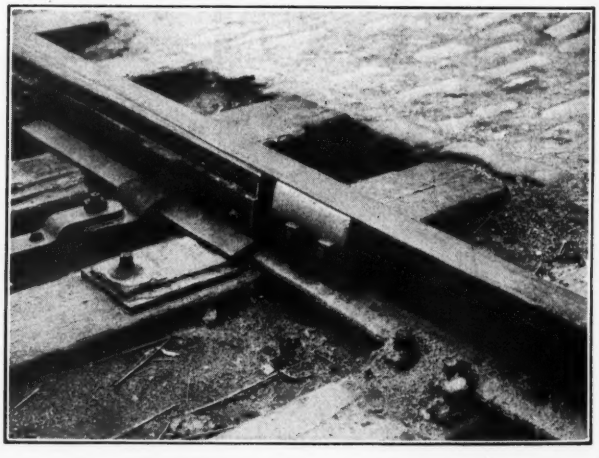

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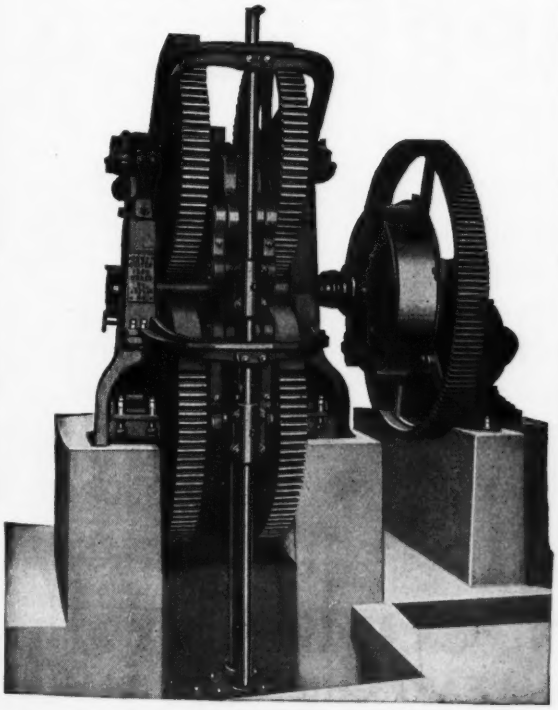

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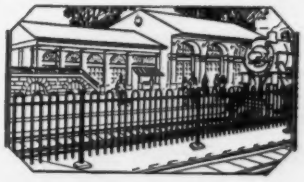

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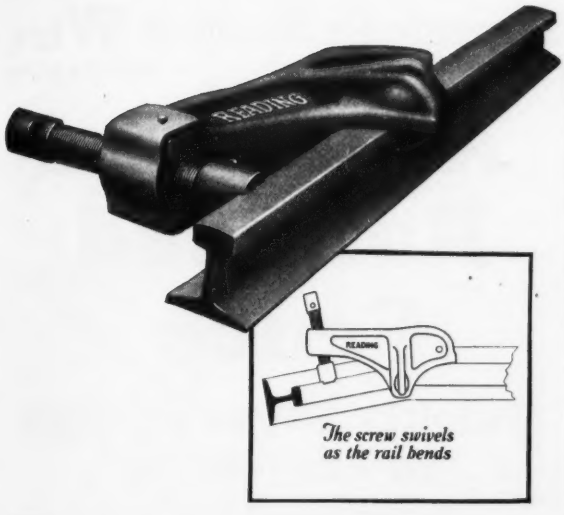

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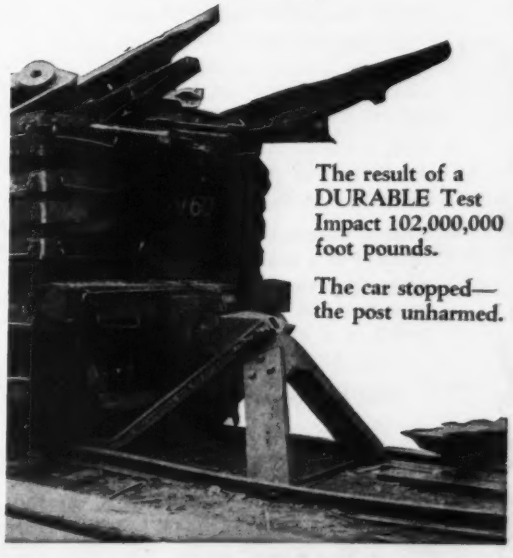
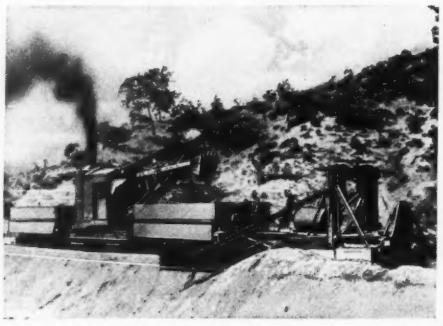


The result of a DURABLE Test Impact 102,000,000 foot pounds.

The car stopped—the post unharmed.



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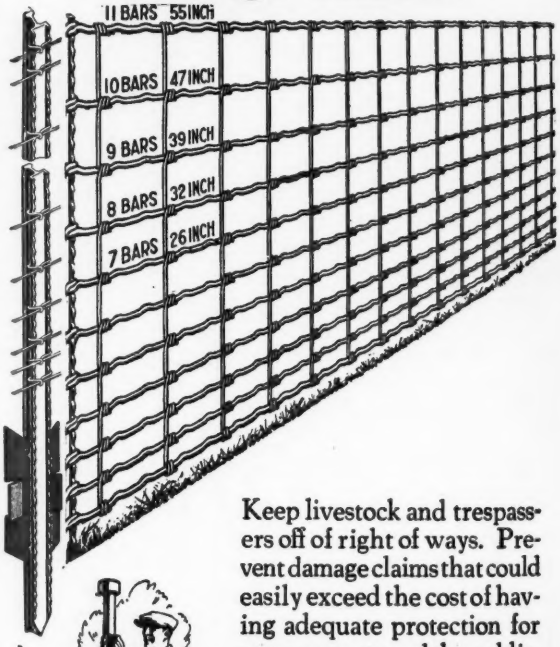

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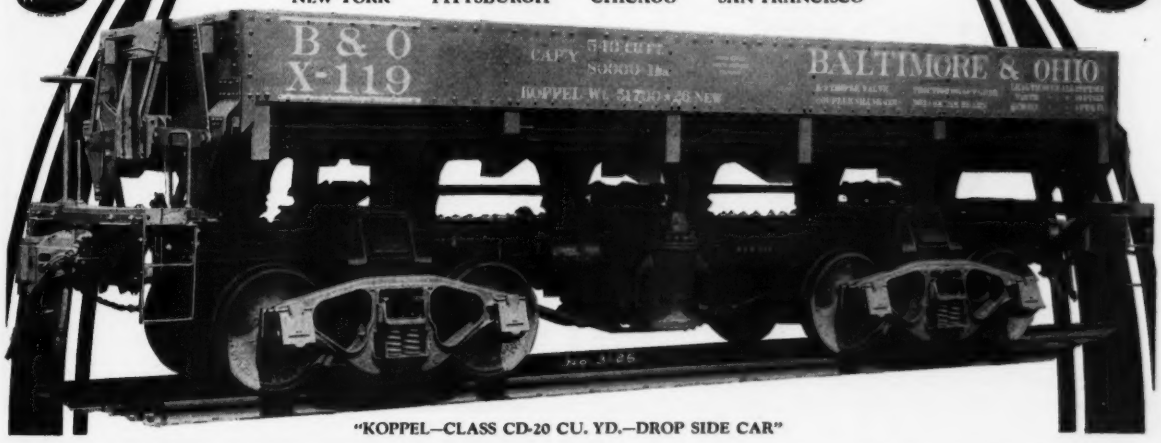

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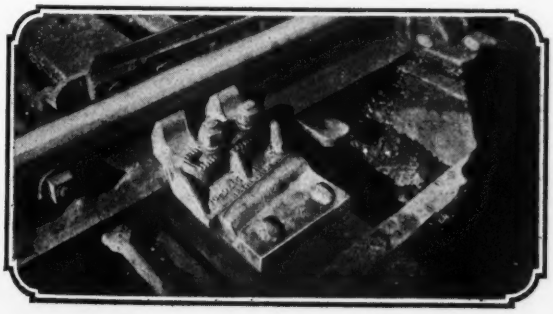

These are three important features of the Improved Bethlehem Adjustable Rail Brace.

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with its pigment of flake silica-graphite possesses to an unusual degree that peculiar quality of water repellancy.

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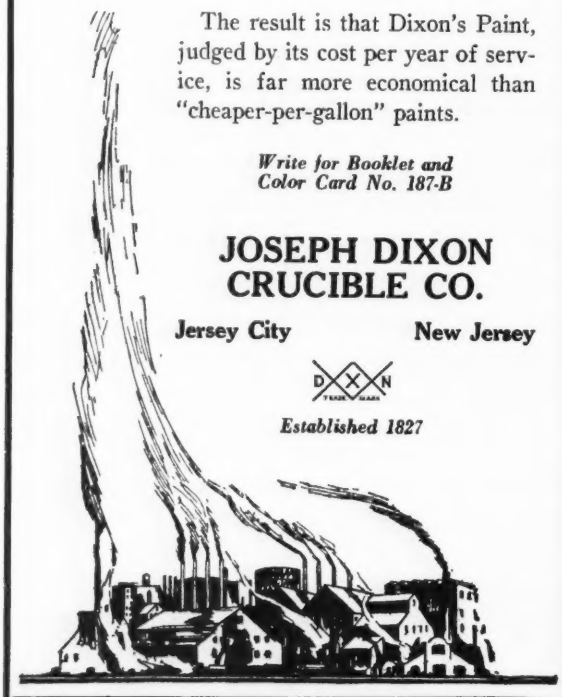

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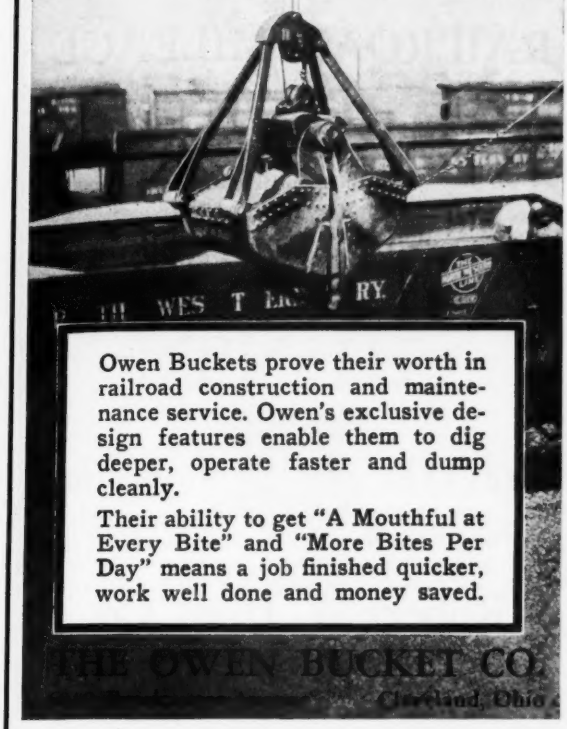

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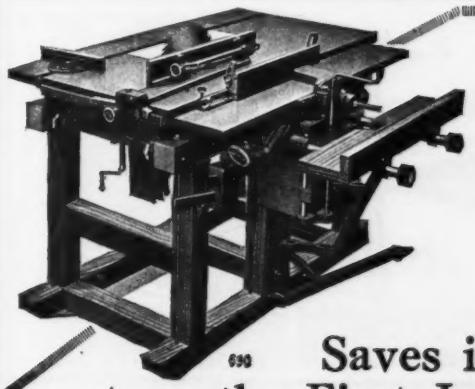

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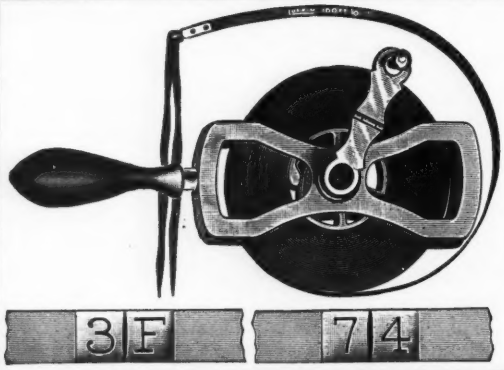

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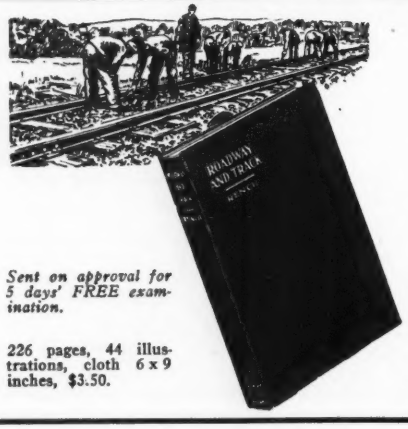

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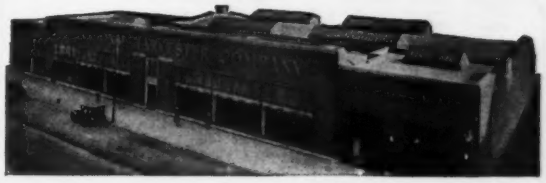

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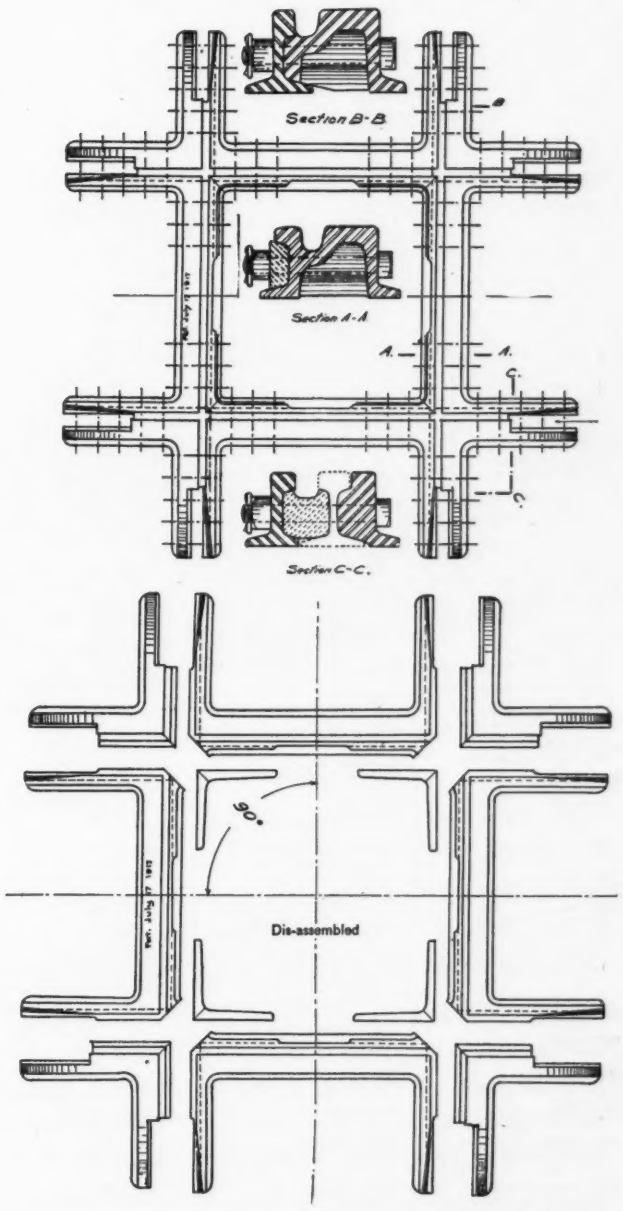

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Q. & C. Co.
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Verona Tool Works

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Buda Co.
Coover Railroad Track Brace Co.
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Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

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Rails, Tee
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Steel, Electric Furnace
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Steel, Open Hearth
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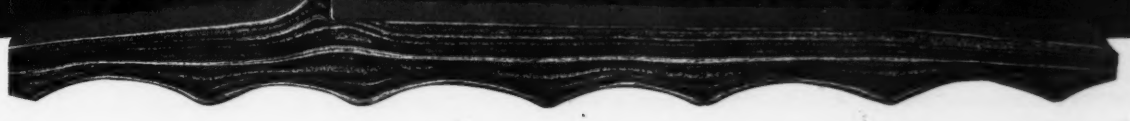

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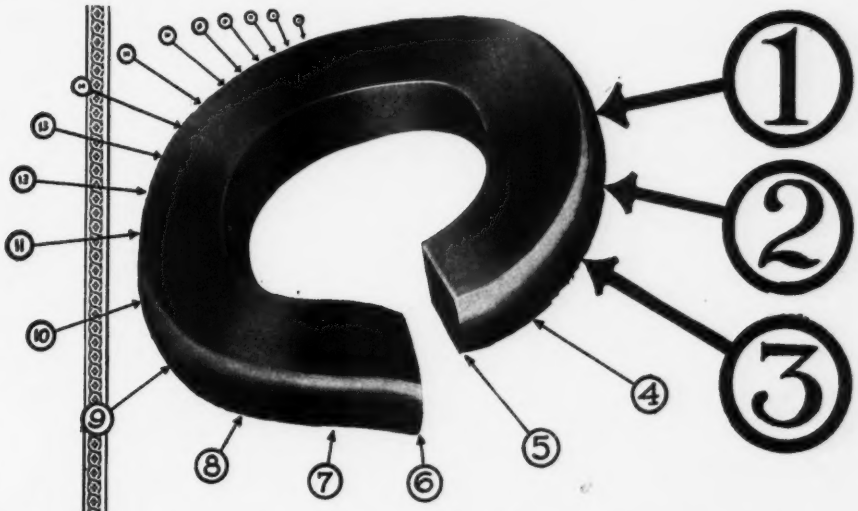

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This is point of superiority No. 3

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WHEN a spring washer is compressed flat it transmits the full impact of a blow just as the ordinary flat washer does. Continued impacts on such a joint connection result in loosened bolts. Loosened bolts permit the battering of rail ends, and the mutilation of joint bars. And *that costs the railroads thousands and thousands of dollars.*

IMPROVED HIPOWER is a *stiff spring* with tremendous reactive power. It retains its *spring* under terrific pounding and pressure. It holds bolts tight longer than any spring washer on the market. It is commercially non-flattenable.

IMPROVED HIPOWER primarily *retards* wear, and secondarily it compensates for the wear that inevitably occurs. And it costs 90% less per 1,000 lbs. pressure than plain coil spring washers.

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The National Lock Washer Co.

Newark, New Jersey, U. S. A.

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OVER twenty years ago we advocated to the railroads of this country the adoption of a drastic new theory pertaining to the proper functioning of spring washers, then termed nut locks. The immediate response was none too encouraging.

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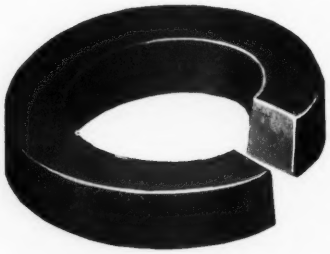
Commercially Non-flattenable - - Permanently Rust-Proof

The "Daddy" of Them All



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